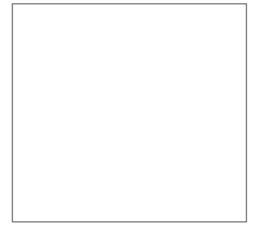




Including examiner comments



R2101

PLANT CLASSIFICATION, STRUCTURE & FUNCTION

Level 2

Monday 6 February 2023

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

Q1 a) State **ONE** distinct difference between monocotyledonous and dicotyledonous plants for **EACH** of the plant parts shown, by completing the table below:

Plant part	Monocotyledonous plant	Dicotyledonous plant
Root		
Leaf		
Flower		

2

2

2

b) State what is meant by the term 'herbaceous perennial'.

2

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c) **NAME ONE** herbaceous monocotyledonous and **ONE** herbaceous dicotyledonous plant.

2

Herbaceous monocotyledonous plant

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Herbaceous dicotyledonous plant

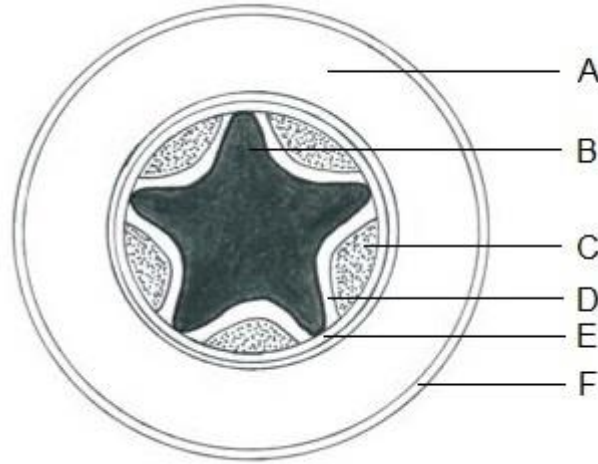
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Total Mark

Please see over/.....

Q2 a) Name **EACH** of the features labelled A-F on the diagram of a young dicotyledonous root below:



Young dicotyledonous root

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

b) Identify which of the features labelled on the diagram in a) carry out the following functions:

- i) cell division
- ii) starch storage
- iii) production of lateral roots
- iv) transport of sugars

- i).....
- ii).....
- iii).....
- iv).....

4

Total Mark

MARKS
2

Q3 a) State what is meant by the term 'plant tissue'.

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b) For **EACH** of the following plant tissues state **THREE** distinct structural characteristics:

- i) parenchyma
- ii) epidermis

3
3

i).....
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ii).....
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c) State the location of the following tissues in a leaf:

- i) parenchyma
- ii) epidermis

2

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

Please see over/.....

MARKS

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

3

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b) Describe how waterlogging in soils affects:

- i) plant respiration
- ii) plant growth

**4
3**

i).....

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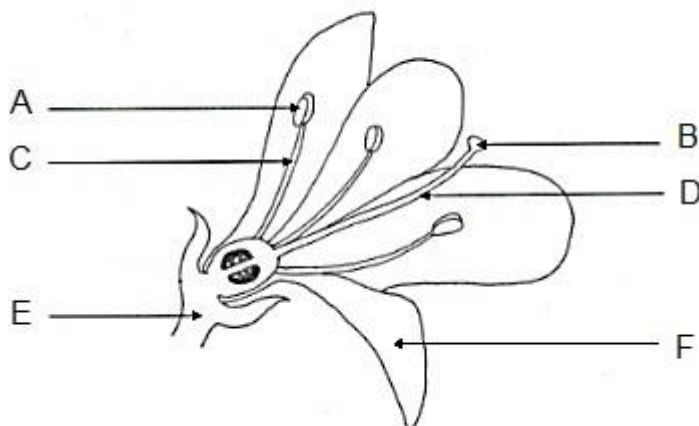
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Total Mark

Please turn over/.....

Q5 a) Name **EACH** of the features labelled A-F on the diagram below:

A typical dicotyledonous flower



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

b) Name the method by which pollen is transferred in the flower shown in a).

1

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.....

c) State how **THREE** of the features labelled in a) enable successful pollination to be achieved.

3

Feature 1.....
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Feature 2.....
.....
Feature 3.....
.....

Total Mark

Please see over/.....

MARKS
1

Q6 a) Name the process of water loss from leaves.

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.....

b) Describe **THREE** leaf adaptations to minimise water loss giving a distinct **NAMED** plant example for **EACH** adaptation by completing the table below:

Adaptation		Named plant example
1.		
2.		
3.		

3

3

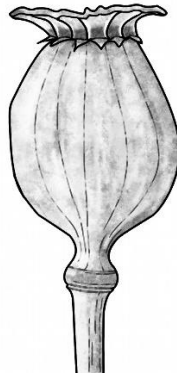
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Total Mark

Please turn over/.....

Q7 a) Describe the dispersal mechanism of the fruits shown below giving **ONE NAMED** plant example for **EACH** fruit.

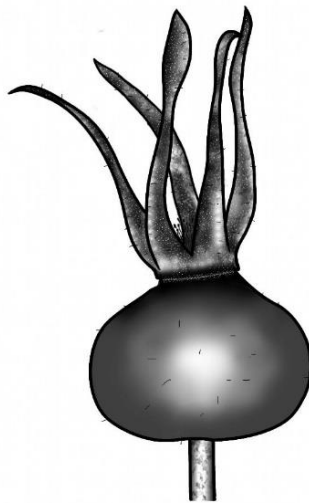
MARKS
9



Description of dispersal mechanisms.....

.....

Plant example



Description of dispersal mechanisms.....

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Plant example

.....

Question 7 continues overleaf



Description of dispersal mechanism.....

.....

Plant example

b) State **ONE** function of fruits other than seed dispersal.

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1

Please see over/.....

Total Mark

Q8 a) State the function of **EACH** of the following components of a plant cell:

- i) chloroplast
- ii) nucleus
- iii) mitochondrion
- iv) vacuole

MARKS

1
1
1
1

i).....

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ii).....

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iii).....

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iv).....

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b) Describe how the following substances enter plant cells:

- i) water
- ii) mineral nutrients

3
3

i).....

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Total Mark

Please turn over/.....

Q9 a) Describe **THREE** distinct plant adaptations for climbing or support by completing the table below:

MARKS

Name of adaptation	Plant part adapted	Plant example

3

3

3

b) State **ONE** reason why plants are adapted for climbing or support.

1

.....

Total Mark

Please see over/.....

MARKS

Q10a) State what is meant by **EACH** of the following terms:

- i) senescence
- ii) death

1
1

i).....
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ii).....
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b) State **TWO** benefits of senescence of plants or plant organs in horticulture.

4

Benefit 1.....
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Benefit 2.....
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c) State **TWO** limitations of senescence of plants or plant organs in horticulture.

4

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

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R2101

PLANT CLASSIFICATION, STRUCTURE & FUNCTION

Level 2

Monday 6 February 2023

Candidates Registered		Total Candidates Passed	
Candidates Entered	221	Passed with Commendation	61
Candidates Absent/Withdrawn	TBA	Passed	102
Candidates Deferred	TBA	Failed	61

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

Q1

- a) State **ONE** difference between monocotyledonous and dicotyledonous plants for **EACH** of the plant parts by completing the table below:

Plant parts	Monocotyledonous plant	Dicotyledonous plant
Root		
Leaf		
Flower		

- b) State what is meant by the term 'herbaceous perennial'
- c) **NAME ONE** herbaceous monocotyledonous and **ONE** herbaceous dicotyledonous plant

Herbaceous monocotyledonous plant

Herbaceous dicotyledonous plant.....

- Q1a)** To gain full marks candidates were required to give precise answers for each difference between monocotyledonous and dicotyledonous plant parts. The best answers included:

Plant part	Monocotyledonous plant	Dicotyledonous plant
Root	<p>Fibrous root system.</p> <p>Do not undergo secondary thickening/do not have any vascular cambium.</p> <p>Multiple 'arms' in stele.</p>	<p>Tap/primary root system.</p> <p>Undergo secondary thickening/have vascular cambium.</p> <p>Stele is star shaped with up to seven 'arms'.</p>
Leaf	<p>Parallel venation.</p> <p>Lanceolate or strap-shaped leaves.</p> <p>Smooth or entire leaf margins.</p> <p>Equal number of stomata on upper and lower surfaces.</p>	<p>Branching or reticulate venation.</p> <p>Various shaped leaves e.g. palmate.</p> <p>Range of leaf margins e.g. serrate.</p> <p>More stomata on lower surface.</p>

Flower	Flower parts in 3's. Petals and sepals fused/indistinct/not separated/tepals. Pollen with one furrow – monosulcate.	Flower parts in multiples of 4 or 5. Petals and sepals are separate and distinctive. Pollen with 3 furrows – trisulcate.
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Q1b) The majority of candidates were able to correctly state the meaning of the term 'herbaceous perennial' and were awarded full marks. Suitable answers included:

An herbaceous perennial is a non woody structure/with no secondary thickening/where the top growth dies down in the winter. It has a life cycle of three or more years.

Q1c) Full marks were awarded to candidates who provided correctly written full botanical names for plant examples. These included:

Herbaceous monocotyledonous plant

Zea mays, Poa annua, Stipa tenuissima, Narcissus pseudonarcissus, Galanthus nivalis, Allium sativum.

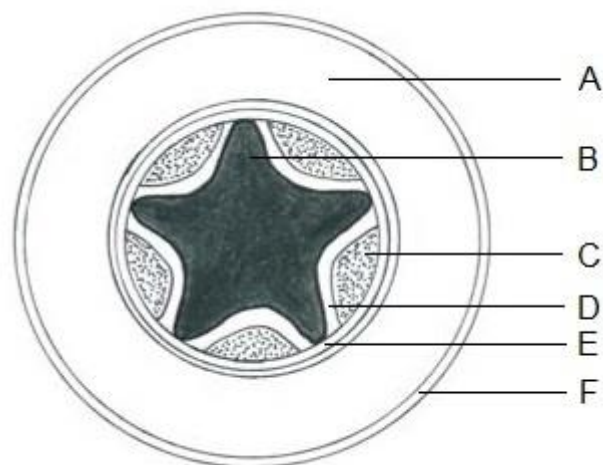
Herbaceous dicotyledonous plant

Taraxacum officinale, Alchemilla mollis, Papaver 'Patty's Plum', Geranium phaeum.

Q2

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

Young dicotyledonous root



- b) Identify which of the features labelled on the diagram in a) carry out the following functions:

- i) Cell division
- ii) Starch storage
- iii) Production of lateral roots
- iv) Transport of sugars

- Q2a)** Candidates who were able to correctly name the features of a young dicotyledonous root i.e.

- A** = Cortex
- B** = Xylem
- C** = Phloem
- D** = Vascular cambium/cambium
- E** = Pericycle
- F** = Epidermis

were awarded maximum marks.

Candidates who confused the pericycle with the endodermis and cortex with pith due to confusing stem with root could not be awarded any marks.

Q2b) To achieve full marks candidates were required to identify which of the features of a young dicotyledonous root carry out specific functions. Acceptable answers included:

- i) cell division – D/Vascular cambium or E/pericycle
- ii) starch storage – A/cortex
- iii) production of lateral roots – E/pericycle
- iv) transport of sugars – C/phloem

Q3

- a) State what is meant by the term 'plant tissue'

- b) State **THREE** distinct structural characteristics of **EACH** of the following plant tissues:

- i) parenchyma
 - 1.
 - 2.
 - 3.
- ii) epidermis
 - 1.
 - 2.
 - 3.

- c) State the location of the following tissues in a leaf

- i) parenchyma.....
- ii) epidermis.....

Q3a) Candidates who correctly stated that 'plant tissue' is a group or collection of cells which carry out a specific or single function gained maximum marks.

Q3b) Many candidates were able to provide suitable structural characteristics for specific plant tissues and achieved maximum marks. These included:

- i) **parenchyma** has spherical or rounded cells, air spaces between cells or loosely packed cells, cells with a large vacuole and a thin cellulose cell wall. Parenchyma cells contain organelles e.g. nuclei, chloroplasts and mitochondria.

- ii) **epidermis** one cell thick, having no chloroplasts and therefore transparent, being tightly packed with no air spaces between cells, having flattened cells and an outer waxy layer or cuticle. The mention of modified cells e.g. those forming stomata, leaf hairs etc. or the presence of organelles, a vacuole or cytoplasm were also credited with marks.

Candidates who stated functions instead of structural characteristics could not be awarded any marks.

Q3c) The best candidates were able to state suitable locations of specific tissues in a leaf and gained maximum marks. These included:

- i) **parenchyma** makes up the spongy and palisade mesophyll layers in the leaf.

- ii) **epidermis** makes up the entire surface of the leaf. It is found above the palisade mesophyll and below the spongy mesophyll.

Q4

a) State the equation for aerobic respiration in words

b) Describe how waterlogging in soils affects:

- i) plant respiration
- ii) plant growth

Q4a) Oxygen + glucose/carbohydrate/starch/sugar \rightarrow Carbon dioxide + water + energy/ATP

Q4b) Good descriptions of how waterlogging in soils affects plant respiration and plant growth were provided by many candidates who achieved maximum marks. Suitable answers included:

i) **plant respiration**

Waterlogging fills soil pores with water which excludes oxygen availability to root cells. A lack of oxygen leads to a reduction in aerobic respiration and a switch to anaerobic respiration in these cells. Waterlogged soils will also be cold which will slow the rate of respiration.

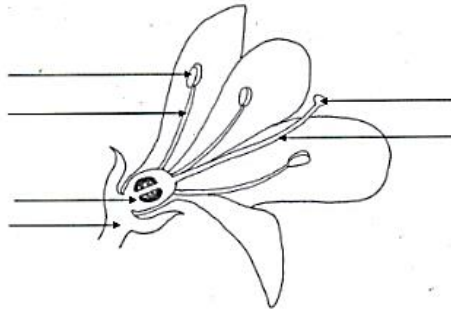
ii) **plant growth**

Reduced aerobic respiration will reduce energy for growth leading to stunted plants. Anaerobic respiration, as well as producing minimal energy, also produces toxic ethanol which will lead to root cell death. This will reduce the ability of the plant to take up water and minerals resulting in wilting in the aerial parts of the plant. These will become yellow (chlorotic) leading to reduced growth.

Q5

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

A typical dicotyledonous flower



b) Name the method by which pollen is transferred in the flower shown in a)

c) State how **THREE** of the features labelled in a) enable successful pollination to be achieved

Feature 1.....

Feature 2.....

Q5a) Candidates who were able to correctly name the features of a dicotyledonous flower i.e.

- A** = Anther
- B** = Stigma
- C** = Filament
- D** = Style
- E** = Receptacle
- F** = Petal

gained full marks.

Q5b) The majority of candidates correctly named the method by which pollen is transferred in a dicotyledonous flower as insect/bee pollination and achieved full marks.

Q5c) To be awarded full marks candidates were required to provide details of how a number of features of a dicotyledonous flower enable successful pollination to be achieved. Suitable answers included:

A – Anther releases pollen which brushes against the insect and sticks to it.

B – Stigma is sticky and catches pollen from the body of the insect as it brushes past.

C – Filament holds the anther in the correct position for pollen transfer e.g. short filaments hold anther within the flower so insects can brush against it.

D – Style holds stigma in correct position for pollen transfer to enable the insect to brush against it e.g. a short style holds the style within the flower.

E – Receptacle holds all the flower parts in the correct position for insects to be attracted to the flower and for pollen to be transferred.

F – Petals are brightly coloured and often scented to attract insects. They may have nectar guides and a nectary at their base as a reward for insects.

Candidates who described features of wind pollinated flowers or flower parts not labelled on the diagram could not be awarded any marks.

Q6

- a) Name the process of water loss from leaves
- b) Describe **THREE** leaf adaptations to minimise water loss giving a distinct **NAMED** plant example for **EACH** adaptation

Adaptation 1.....

Plant example.....

Adaptation 2.....

Plant example.....

Adaptation 3.....

Plant example.....

Q6a) Most candidates correctly named 'transpiration' as the process whereby water is lost from leaves and were awarded full marks.

Q6b) Candidates were required to describe suitable leaf adaptations to minimise water loss including a plant example for full marks. Acceptable answers included:

Adaptation		Named Plant Example
1	<p>Leaf hairs – which increase humidity/trap moisture/reduce wind speed close to the leaf or shade the leaf lowering leaf temperature.</p> <p>Sunken stomata – which increase humidity/reduce wind speed close to the leaf.</p>	<p><i>Stachys byzantina,</i> <i>Phlomis lanata.</i></p> <p><i>Pinus sylvestris, Nerium oleander.</i></p>
2	<p>Thick cuticle – which is a waterproofing/waxy layer.</p> <p>Needles or scale leaves - with a reduced leaf area.</p>	<p><i>Camellia japonica,</i> <i>Aucuba japonica.</i></p> <p><i>Pinus mugo, Taxodium distichum</i> (needles), <i>Thuja plicata</i> (scale leaves).</p>
3	<p>Leaf rolling – to reduce the surface area.</p> <p>Spines – which reduce leaf area/reduce air flow/provide shade and therefore lower temperature/trap moisture.</p>	<p><i>Ammophila arenaria.</i></p> <p><i>Opuntia abjecta,</i> <i>Mammillaria albiflora.</i></p>

Q7

- a) Describe the dispersal mechanism of the fruits shown below giving **ONE NAMED** plant example for **EACH** fruit



X

Description.....

Plant example.....



Y

Description.....

Plant example.....



Z

Description.....

Plant example.....

- b) State **ONE** function of fruits other than seed dispersal

Q7a) Full marks were awarded to the best candidates who were able to identify and describe the dispersal mechanism for each of the fruits shown in the diagrams along with suitable plant examples. These included:

Diagram 1

Shows a poppy capsule. The dispersal mechanism is wind, which shakes the capsule dispersing the seeds through pores. This is also described as a 'censer' or 'pepper pot' mechanism e.g. *Papaver somniferum*, *Papaver* 'Patty's Plum'.

Diagram 2

Shows a rosehip. The dispersal mechanism is by animals who ingest the succulent fruit and excrete the seeds. This is also known as frugivory e.g. *Rosa rugosa*, *Rosa canina*.

Diagram 3

Shows a dandelion. Dispersal is by wind using a 'parachute' mechanism. The pappus structure of the fruit enables the fruits to drift on wind currents e.g. *Taraxacum officinale*, *Cirsium arvense*.

Q7b) A range of functions of fruits other than wind dispersal were provided by many candidates who achieved maximum marks. Acceptable answers included:

- promoting dormancy
- delaying germination
- protecting the seed on the plant from damage, disease or desiccation
- providing moisture and nutrients to the seed.

Q8

a) State the function of **EACH** of the following components of a plant cell:

- i) chloroplast
- ii) nucleus
- iii) mitochondrion
- iv) vacuole

b) Describe how the following substances enter plant cells:

- i) water
- ii) mineral nutrients

Q8a) Maximum marks were awarded to candidates who were able to state a function for specific components of a plant cell.

Suitable answers included:

- i) **chloroplast**
Site of photosynthesis. Generates sugars, glucose or carbohydrate.
- ii) **nucleus**
Contains DNA which controls the activity of the cell and cell division.
- iii) **mitochondrion**
Site of aerobic respiration. Breakdown of glucose and generation of energy.
- iv) **Vacuole**
Stores waste substances and some minerals. Controls cell turgor and expansion.

Q8b) Good descriptions of how specific substances enter plant cells were provided by the best candidates who gained full marks. These included:

- i) **water**
Water enters plant cells through the process of osmosis. Osmosis is the uptake of water across a semi-permeable cell membrane from a high water (low solute) concentration outside the cell to a low water (high solute) concentration inside the cell.
- ii) **mineral nutrients**
Uptake of minerals is an active process requiring energy/ATP and generally crossing the cell membrane against a concentration gradient. It is also a selective process with minerals being transferred on specific protein carriers embedded in the cell membrane.

Q9

- a) Describe **THREE** distinct plant adaptations for climbing or support by completing the table below:

Name of adaptation	Plant part adapted	Plant example

- b) State **ONE** reason why plants are adapted for climbing or support

- Q9a)** A range of plant adaptations for climbing or support were described by many candidates who achieved full marks. Suitable answers included:

Name of adaptation	Plant part adapted	Plant example
Tendril	Leaf/leaflet	<i>Pisum sativum</i> , <i>Lathyrus odoratus</i> .
Petiole	Inflorescence	<i>Vitis vinifera</i> , <i>Passiflora edulis</i> , <i>Parthenocissus tricuspidata</i> .
Tendril/twining petiole	Stem Leaf petiole	<i>Citrullus lanatus</i> . <i>Clematis armandii</i> .
Twining stem/liane	Stem	<i>Wisteria sinensis</i> .
Prop root	Root	<i>Zea mays</i> .
Adventitious or aerial root	Root	<i>Hedera helix</i> , <i>Hydrangea anomala</i> subsp. <i>Petiolaris</i> .
Prickle	Stem	<i>Rosa</i> 'Rambling Rector', <i>Rosa canina</i> , <i>Rubus fruticosus</i> .

Q10

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

- i) senescence
- ii) death

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

Benefit 1.....

Benefit 2.....

c) State **TWO** limitations of senescence of plants or plant organs in horticultural

Limitation 1.....

Limitation 2.....

Q10a) Many candidates were able to provide suitable meanings for the specific terms and achieved maximum marks. These included:

i) **senescence**

Senescence is when plants 'die back', or the stage between adult and death in the plant life cycle, or the stage when sexual reproduction stops and growth ceases and metabolism slows down.

ii) **death**

Death is the stage where all cellular processes e.g. photosynthesis and respiration or metabolism itself ceases.

Q10b) Maximum marks were awarded to candidates who were able to provide suitable benefits of senescence of plants or plant organs in horticulture. These included:

- seeds are mature and ready to collect for propagation or food or desirable self-seeding
- autumn leaf colour provides interest in a border
- retained leaves provide an ornamental hedge feature
- leaf senescence indicates harvest time in some crops e.g. onions or potatoes
- leaf senescence indicates poor plant health e.g. lack of nitrogen
- senescent seed heads provide food for or attract birds in wildlife gardens or provide winter interest or indicates the time to deadhead plants to encourage the production of more flowers
- senescence is the main phase for production of perennating organs which can be used for propagation e.g. division or for provision of food crops e.g. carrots.

Q10c) Candidates who were able to provide suitable limitations of senescence of plants or plant organs in horticulture achieved full marks. These included:

- a loss of quality and value for cut flowers or fruits
- unattractive foliage due to leaf senescence or herbaceous plants dying back in winter are unsightly in a border.
- flowering ends and therefore the ornamental effect is lost in a border
- falling leaves present a slip hazard in a garden or can damage lawns
- leafy stem cuttings root less easily and hence some propagation is less effective leading to fewer plants
- dead or senescent foliage could harbour pests and diseases
- seed heads shed seeds which may be undesirable with the potential to create weeds in borders.