

**R2101**

**PLANT CLASSIFICATION, STRUCTURE & FUNCTION**

**Level 2**

**Monday 18 June 2018**

**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.



**Q2 a)** Describe how **EACH** of the following flower parts may be adapted for wind and bee pollination by completing the table below.

Flower part	Wind pollinated	Bee pollinated
<b>Pollen</b>		
<b>Stigma</b>		

**4**

**4**

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

**1**

.....  
 .....  
 .....

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

**1**

.....  
 .....  
 .....

Total Mark
------------

**Please turn over/.....**

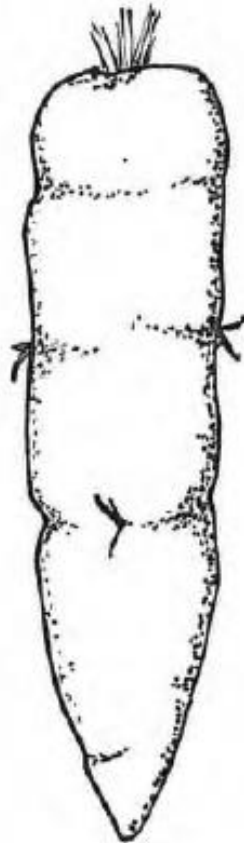
**MARKS**  
**1**

**Q3 a)** Name **ONE** primary function of roots.

.....  
.....  
.....  
.....

**b)** Identify and state the function of **EACH** root adaptation shown below.  
Give a **NAMED** plant example for **EACH**:

**X**



Name of adaptation .....

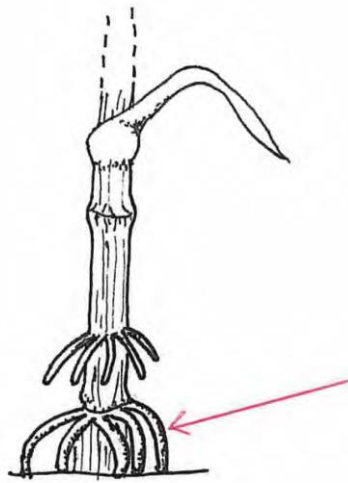
**3**

Function of adaptation .....

Plant example .....

**Please see over/.....**

**Y**



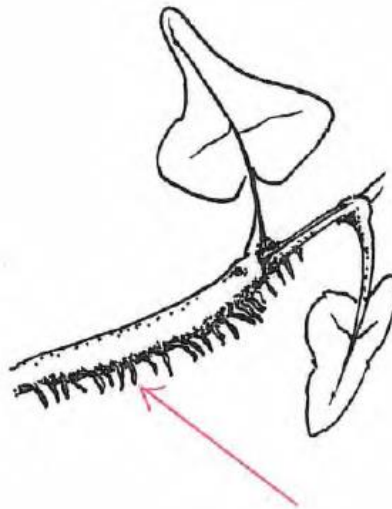
Name of adaptation .....

**3**

Function of adaptation .....

Plant example .....

**Z**



Name of adaptation .....

**3**

Function of adaptation .....

Plant example .....

Total Mark

**Please turn over/.....**



**MARKS**

**2**

**Q5 a)** State what is meant by the term plant tissue.

.....  
.....  
.....  
.....

b) For **EACH** of the types of tissues listed in the table below, give

- i) a named example;
- ii) **THREE** structural characteristics;

by completing the table below.

**8**

Type of tissue	Named example	Structural characteristics
<b>Meristematic</b>		1.  2.  3.
<b>Packing</b>		1.  2.  3.

Total Mark

Please turn over/.....

**Q6 a)** Name the plant cell component where **EACH** of the following take place:

- i) photosynthesis;
- ii) control of cell turgor;
- iii) up-take (absorption) of minerals;
- iv) aerobic respiration.

**MARKS**

1  
1  
1  
1

i).....

.....

ii).....

.....

iii).....

.....

iv).....

.....

**b)** Describe how cellular respiration is affected by **EACH** of the following environmental conditions:

- i) very high temperatures;
- ii) lack of oxygen.

2  
4

i).....

.....

.....

.....

.....

.....

.....

.....

.....

.....

.....

.....

.....

.....

.....

.....

.....

.....

.....

.....

.....

.....

Total Mark

**Please see over/.....**



**MARKS**

**Q7 a)** Draw a fully labelled cross-section of a young dicotyledonous stem in the space below.

**7**

b) Label where **EACH** of the following processes take place on the diagram drawn in a):

**3**

- i) starch storage;
- ii) mineral transport;
- iii) cell division.

Total Mark

**Please turn over/.....**



**MARKS**

**Q9 a) NAME** the part of the flower from which the seed develops.

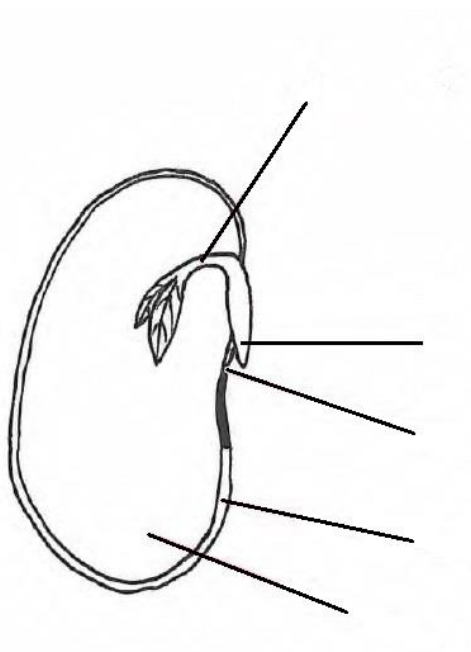
**1**

.....  
.....  
.....

**b) NAME EACH** of the seed parts indicated on the diagram below:

**5**

Internal structure of a seed



**c) State** what is meant by the terms 'epigeal' and 'hypogeal' germination giving a **NAMED** plant example for **EACH**:

**2**

i) Epigeal germination.....  
.....  
.....

Plant example.....

ii) Hypogeal germination.....  
.....  
.....

Plant example.....

Total Mark

**Please turn over/.....**

**Q10a** State **TWO** distinct differences between monocotyledonous and dicotyledonous plants for **EACH** plant organ named, by completing the table below.

Plant organ	Monocotyledonous plant	Dicotyledonous plant
Stem	1.  2.	1.  2.
Flower	1.  2.	1.  2.

4

4

b) Name **ONE** monocotyledonous and **ONE** dicotyledonous plant.

2

Monocotyledonous.....  
 .....  
 Dicotyledonous.....  
 .....

Total Mark
------------

\*\*\*\*\*

**PLEASE DO NOT USE THIS PAGE**

**PLEASE DO NOT USE THIS PAGE**

**PLEASE DO NOT USE THIS PAGE**

**©These questions are the property of the Royal Horticultural Society.  
They must not be reproduced or sold.  
The Royal Horticultural Society, Wisley, Woking, Surrey GU23 6QB.  
Charity Registration Number: 222879/SC038262**





Sharing the best in Gardening

**R2101**

**PLANT CLASSIFICATION, STRUCTURE & FUNCTION**

**Level 2**

**Monday 18 June 2018**

<b>Candidates Registered</b>	<b>445</b>		<b>Total Candidates Passed</b>	<b>279</b>	<b>75%</b>
Candidates Entered	370	83%	Passed with Commendation	146	39%
Candidates Absent/Withdrawn	68	15%	Passed	133	36%
Candidates Deferred	7	2%	Failed	91	25%

**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.

	<b>MARKS</b>
<b>Q1 a)</b> State <b>FOUR</b> limitations of using common names compared with botanical names for plants.	<b>4</b>
<b>b)</b> State what is meant by <b>EACH</b> of the following terms:	
i) species;	<b>2</b>
ii) cultivar.	<b>2</b>
<b>c)</b> Name <b>TWO</b> distinct plant cultivars.	<b>2</b>

**Q1a)** The best candidates who gained full marks provided four distinct limitations of using common names for plants. These included:

- Common names are not universally recognised
- Common names may be in a different language
- Common names do not show relatedness between plants
- Plants may not have a common name
- The same plant may have several common names
- Many plants may have the same common name

Candidates who gave the benefits of using botanical names rather than the limitations of common names were awarded marks as long as the comparison was clear.

**Q1b)** Candidates who were able to clearly state what is meant by a species and a cultivar were awarded full marks. These included:

- i) Species is a group of plants within a genus whose individuals have characteristics in common and can interbreed with each other.
- ii) A cultivar is a variation of, or a sub-group within a species, which is selected or created by people/plant breeders. It then has to be maintained in cultivation, often by vegetative propagation or by continuous selection. It is a cultivated variety.

**Q1c)** Maximum marks were awarded to candidates who were able to name two distinct cultivars e.g. *Acer platanoides* 'Crimson King', *Euonymus fortunei* 'Emerald Gaiety' or *Sorbus aria* 'Lutescens'.

Candidates should avoid plants where trade designations are in common use rather than the cultivar name e.g. *Rosa* Darcey Bussell is the cultivar *Rosa* 'Ausdecorum'

**Q2 a)** Describe how **EACH** of the following flower parts may be adapted for wind and bee pollination by completing the table below.

Flower part	Wind pollinated	Bee pollinated
Pollen		
Stigma		

**4**

**4**

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

**1**

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

**1**

**Q2 a)** To gain full marks candidates were required to provide descriptions of how pollen and the stigma have been adapted for wind and bee pollination. Suitable answers included:

Wind pollinated flowers produce very large amounts of pollen which is smooth, small and lightweight. The stigma is flexible/moveable in the wind, hangs outside of the flower and is often feathery to increase its surface area.

Bee pollinated flowers release small amounts of large pollen grains inside of the flower structure with pollen grains having a rough surface that will stick to a bee's body. The stigma may be sticky and is positioned inside the flower structure where the bee can brush against it.

**Q2 b)** Most candidates were able to name a wind pollinated flower and were awarded full marks. Acceptable answers included; *Zea mays*, *Betula pendula*.

**Q2 c)** Candidates who provided suitable examples of bee pollinated flowers e.g. *Lavandula angustifolia*, *Digitalis purpurea* gained full marks.

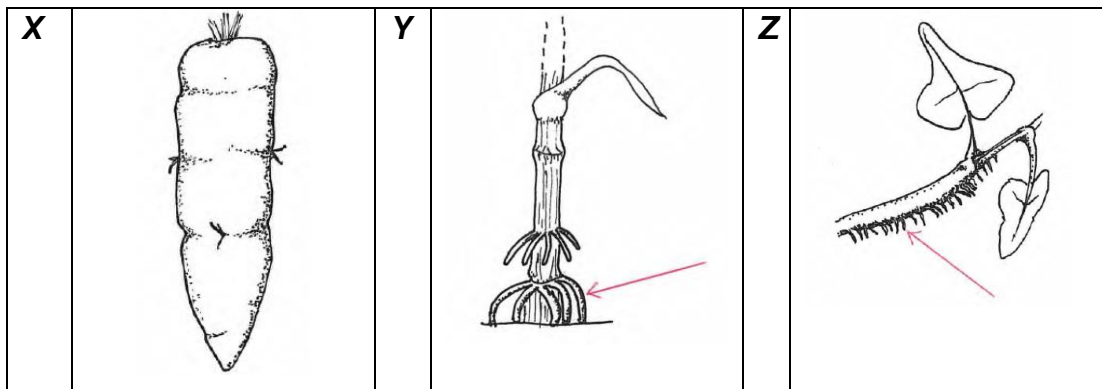
Candidates who confused pollination with seed dispersal could not be awarded any marks.

Candidates who gave examples of conifers as having wind pollinated flowers could not be awarded any marks as although conifers are usually wind pollinated they are not flowering plants.

**Q3 a)** Name **ONE** primary function of roots.

**1**

**b)** Identify and state the function of **EACH** root adaptation shown below.  
Give a **NAMED** plant example for **EACH**:



**3**

**3**

**3**

**Q3a)** Most candidates correctly named a function of roots e.g. uptake of water and minerals or anchorage and gained full marks.

**Q3b)** Candidates who correctly identified and stated the function of the root adaptations, providing a suitable plant example for each were awarded full marks. These were:

**X** – Swollen or enlarged tap root which stores starch/carbohydrate or perennation e.g. *Daucus carota*

**Y** – Prop root which provides the plant with additional stability to stop it falling over in strong winds e.g. *Zea mays*

**Z** – Aerial root to enable a plant to climb to improve its ability to photosynthesise, attract pollinators or to disperse its seeds e.g. *Hedera helix*

**Q4** Describe how water moves in the plant under **EACH** of the following headings:

- i) uptake by root cells;
- ii) through and out of the leaves.

**5**  
**5**

**Q4)** The best candidates described how water moves in the plant and achieved full marks. Suitable answers for the specific headings included:

- i) **Uptake by root cells** – water uptake into root hair cells by osmosis through the selectively/semi-permeable cell membrane. Water moves from a low solute/high water concentration in the soil to a high solute/low water concentration in the cell. The best candidates referred to the movement of water into root cells via the symplast pathway through the plasmodesmata.
- ii) **Through and out of the leaves** – A description of the process of transpiration was required in answer to this section of the question. It commences with the movement of water through the leaf veins/xylem tissue. Water evaporates from the cell surfaces into air spaces in the leaf. The water vapour then diffuses out through the stomata. Water moves from a high concentration within the leaf to a low concentration in the surrounding air.

Candidates who chose to use diagrams gained marks if they were accurately labelled to show the processes described in the cell or the leaf.

**MARKS**

**2**

**Q5**

State what is meant by the term plant tissue.

For **EACH** of the types of tissues listed in the table below, give

- i) a named example;
- ii) **THREE** structural characteristics;

by completing the table below.

**8**

Type of tissue	Named example	Structural characteristics
Meristematic		1. 2. 3.
Packing		1. 2. 3.

**Q5a)** The majority of candidates were able to state the meaning of the term plant tissue and gained full marks. Suitable answers stated that a plant tissue is a group of cells which work together to carry out a specific function.

**Q5b)** To be awarded full marks for this section of the question candidates were required to provide a named example of each tissue and their structural characteristics. Suitable answers included:

**Meristematic tissue** e.g. apical meristem or vascular cambium has tightly packed, cube shaped cells with a large nucleus, many mitochondria but no vacuole

**Packing tissue** e.g. parenchyma (or a specific tissue example e.g. mesophyll, cortex or pith) has loosely packed spherical cells which have thin walls, a large vacuole and many air spaces between them. They may also store starch or contain chlorophyll/chloroplasts.

**MARKS**

**Q6a)** Name the plant cell component where **EACH** of the following take place:

- |      |                                   |   |
|------|-----------------------------------|---|
| i)   | photosynthesis;                   | 1 |
| ii)  | control of cell turgor;           | 1 |
| iii) | up-take (absorption) of minerals; | 1 |
| iv)  | aerobic respiration.              | 1 |

**Q6b)** Describe how cellular respiration is affected by **EACH** of the following environmental conditions:

- |     |                         |   |
|-----|-------------------------|---|
| i)  | very high temperatures; | 4 |
| ii) | lack of oxygen.         | 2 |

**Q6a)** Maximum marks were achieved by candidates who were able to name the plant cell component where the following take place.

- i) **Photosynthesis** takes place in the chloroplasts
- ii) **Control of cell turgor** is in the vacuole
- iii) **Up-take (absorption) of minerals** is controlled by the cell membrane
- iv) **Aerobic respiration** takes place in the mitochondria

**Q6b)** The best candidates specifically described the effects of the environmental conditions on aerobic respiration and were awarded full marks.

- i) Although increasing temperatures initially increases respiration very high temperatures above 35°C will slow down or stop it as the enzymes which are involved in the process will be destroyed.
- ii) A lack of oxygen results in anaerobic respiration. Anaerobic respiration results in a complete breakdown of glucose and consequently a lower yield of energy. Ethanol is also produced which is toxic to plant cells.



**MARKS**

**Q7a)** Draw a fully labelled cross-section of a young dicotyledonous stem in the space below.

**7**

**Q7b)** Label where **EACH** of the following processes take place on the diagram drawn in a):

- i) starch storage;
- ii) mineral transport;
- iii) cell division.

**1****1****1**

**Q7a)** Candidates who drew a clearly labelled cross-section of a young dicotyledonous stem were awarded marks where labels were accurately attached to the appropriate tissues/structures. These included; distinct vascular bundles arranged in a ring with phloem to the outside, a central vascular cambium and xylem to the inside of the bundles. Other labels included the epidermis, cortex, central pith and cuticle if it was clearly distinguished from the epidermis.

Candidates who drew a longitudinal section of a stem or a stem that had undergone secondary thickening could not be awarded any marks.

**Q7b)** Most of the candidates who were able to draw a fully labelled cross-section of a dicotyledonous stem correctly labelled where specific processes take place and gained maximum marks.

- i) Starch storage takes place in the pith or cortex
- ii) Mineral transport takes place in the xylem or phloem
- iii) Cell division takes place in the vascular cambium

**Q8** Describe **FIVE** distinct characteristics of leaf structure which maximise photosynthesis.

**10**

**Q8)** To gain full marks candidates were required to describe each characteristic and link it to how photosynthesis is maximised. Suitable answers included:

- Air spaces inside the leaf enable the exchange of carbon dioxide and oxygen which is used and released in photosynthesis
- Chloroplasts contain chlorophyll for light absorption of the correct wavelength for photosynthesis
- Stomata on the underside of the leaf, or leaf hairs or a waxy cuticle reduce water loss preventing stomatal closure and wilting which would reduce gaseous exchange and light capture which would reduce photosynthesis
- The epidermis is one cell thick or the cuticle is transparent to enable light to penetrate to the photosynthetic tissue below
- Palisade mesophyll cells are closely packed and arranged on the upper surface of the leaf for maximum light interception for photosynthesis
- The leaf has a large surface area and is thin to maximise light input for photosynthesis
- Veins/xylem and phloem deliver water to the leaf to maintain turgidity maximising light interception and to transport sugars, the product of photosynthesis, away from the leaf
- The petiole holds the leaf in the best position for light capture for photosynthesis
- Chloroplasts can move up and down according to the light intensity to make the best use of available light for photosynthesis

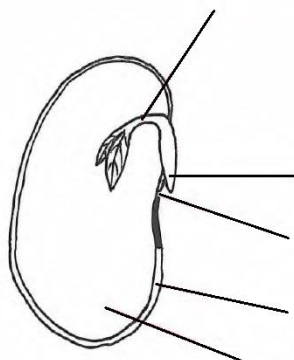
**Q9a)** NAME the part of the flower from which the seed develops.

**1**

**Q9b)** NAME EACH of the seed parts indicated on the diagram below:

**5**

Internal structure of a seed



**Q9c)** State what is meant by the terms 'epigeal' and 'hypogeal' germination giving a **NAMED** plant example for **EACH**:

- i) Epigeal germination
- ii) Hypogeal germination

**2**  
**2**

**Q9a)** Most candidates correctly named the ovule as the part of the flower from which the seed develops and were awarded full marks.

**Q9b)** The majority of candidates were able to label and correctly spell each of the seed parts and gained maximum marks. These were; plumule/epicotyl, radicle, micropyle, testa and cotyledon.

**Q9c)** Maximum marks were gained by candidates who were able to state the meanings of the terms and provided a plant example for each. Suitable answers included:

- i) **Epigeal germination** occurs when the cotyledons emerge above the soil e.g. *Phaseolus vulgaris*
- ii) **Hypogeal germination** occurs when the cotyledons remain below the soil e.g. *Vicia faba*

**Q10a** State **TWO** distinct differences between monocotyledonous and dicotyledonous plants for **EACH** plant organ named, by completing the table below.

Plant organ	Monocotyledonous plant	Dicotyledonous plant
<b>Stem</b>	1.	1.
	2.	2.
<b>Flower</b>	1.	1.
	2.	2.

**4**

**4**

**Q10b** Name **ONE** monocotyledonous and **ONE** dicotyledonous plant.

**2**

**Q10a)** Candidates who compared distinct differences between the plant organs of monocotyledonous and dicotyledonous plants gained full marks. Acceptable answers included:

**Stem**

- i) The arrangement of vascular bundles are scattered in monocotyledonous plants and arranged in a ring in dicotyledonous plants
- ii) The presence of vascular cambium within the bundles is absent in monocotyledonous plants and present in dicotyledonous plants
- iii) Monocotyledonous plants are usually unbranched whereas dicotyledonous plants are usually branched
- iv) Monocotyledonous plants are not woody/no secondary growth whereas dicotyledonous plants can be woody/secondary growth or herbaceous

**Flower**

- i) The flower parts (not the flowers themselves) are present in multiples of three in monocotyledonous plants whereas they are in multiples of four or five in dicotyledonous plants
- ii) Monocotyledonous plants have tepals whereas most dicotyledonous plants have separate petals and sepals
- iii) Monocotyledonous plants have pollen with one pore whereas dicotyledonous plants have pollen with three pores

**Q10b)** The majority of candidates were able to name suitable examples of monocotyledonous and dicotyledonous plants and were awarded full marks. Suitable answers included:

**Monocotyledonous** e.g. *Stipa gigantea*, *Musa basjoo*

**Dicotyledonous** e.g. *Cornus alba*, *Alchemilla mollis*