R2101

PLANT CLASSIFICATION, STRUCTURE & FUNCTION

Level 2

Monday 24 June 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.

Ofqual Unit Code K/505/2967

Please turn over/.....
**Q1** a) Name **TWO** monocotyledonous and **TWO** dicotyledonous plants:

**Monocotyledonous plants:**
1. ................................................................................................................. 2
2. .................................................................................................................

**Dicotyledonous plants:**
1. ................................................................................................................. 2
2. .................................................................................................................

b) State **ONE** difference between monocotyledonous and dicotyledonous plants for **EACH** of the organs listed, by completing the table below:

<table>
<thead>
<tr>
<th>Plant organ</th>
<th>Monocotyledonous plant</th>
<th>Dicotyledonous plant</th>
</tr>
</thead>
<tbody>
<tr>
<td>Flowers</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>
|             |                        |                      | 2
| Leaves      |                        |                      |
|             |                        |                      | 2
| Roots       |                        |                      |
|             |                        |                      | 2

Please see over/.....
Q2 a) Describe what is meant by EACH of the following terms in relation to water movement in a plant:

i) osmosis

ii) diffusion

b) State FOUR functions of water in a plant.
Q3 a) State **ONE** difference between a woody and a herbaceous stem.

b) Name **ONE** woody and **ONE** herbaceous plant:

Woody plant name:  

Herbaceous plant name:  

**Question 3 continues on the facing page**
c) Label the following features of a woody stem on the diagram below:

1. axillary bud;  
2. node;  
3. girdle scar;  
4. apical bud;  
5. lenticel;  
6. leaf scar.

A typical woody dicotyledonous stem

Please turn over/.....
Q4 a) Name the term used to describe the storage of starch over winter for new plant growth in the spring.

b) Describe **THREE** distinct plant adaptations for the storage of starch and give a **NAMED** plant example for **EACH**, by completing the table below:

<table>
<thead>
<tr>
<th>Name of starch storage adaptation</th>
<th>Plant organ adapted</th>
<th>Plant example</th>
</tr>
</thead>
<tbody>
<tr>
<td>1.</td>
<td></td>
<td></td>
</tr>
<tr>
<td>2.</td>
<td></td>
<td></td>
</tr>
<tr>
<td>3.</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

**MARKS**

1

3

3

Total Mark

Please see over/.....
Q5 a) Name the site where photosynthesis takes place in a plant cell.

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b) State the role of chlorophyll in photosynthesis.

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c) Describe how EACH of the following environmental factors affect the rate of photosynthesis:

i) availability of mineral nutrients

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ii) temperature

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Please turn over/.....
Q6  

a) State ONE difference between a fruit and a seed.

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

b) Describe TWO distinct mechanisms by which seeds are dispersed by wind, giving a NAMED plant example for EACH mechanism.

Dispersal method 1:
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Plant example: ........................................................................................................................................
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Dispersal method 2:
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........................................................................................................................................
........................................................................................................................................
........................................................................................................................................
........................................................................................................................................
Plant example: ........................................................................................................................................
........................................................................................................................................
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c) Name TWO seed dispersal mechanisms other than wind.

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Please see over/.....
Q7 a) State what is meant by the term ‘plant tissue’. 

b) For EACH type of plant tissue listed below, give:
   i) TWO structural characteristics;
   ii) TWO functions.

by completing the table below.

<table>
<thead>
<tr>
<th>Plant tissue</th>
<th>Structural characteristics</th>
<th>Functions</th>
</tr>
</thead>
<tbody>
<tr>
<td>Epidermis</td>
<td>1.</td>
<td>1.</td>
</tr>
<tr>
<td></td>
<td>2</td>
<td>2.</td>
</tr>
<tr>
<td>Parenchyma</td>
<td>1.</td>
<td>1.</td>
</tr>
<tr>
<td></td>
<td>2</td>
<td>2.</td>
</tr>
</tbody>
</table>
Q8 a) Draw a labelled diagram of a typical monocotyledonous flower in the space below:

Section through a typical monocotyledonous flower

b) State the function of THREE of the structures labelled in a).
Q9 a) State using words the basic equation for aerobic respiration.

b) State how the rate of aerobic respiration affects the length of time that seeds can be stored.

c) Describe how **TWO** distinct environmental factors are controlled to extend the length of time seeds can be stored.
Q10 a) State the difference between a tap root and a lateral root.

b) Describe **EACH** of the following root features by completing the table below:

<table>
<thead>
<tr>
<th>Root features</th>
<th>Characteristic</th>
</tr>
</thead>
<tbody>
<tr>
<td>Zone of differentiation</td>
<td>1.</td>
</tr>
<tr>
<td>Pericycle</td>
<td>1.</td>
</tr>
</tbody>
</table>
| Root hair         | 1.  
|                   | 2.  |
|                   | 3.  |
| Root cap          | 1.  |
|                   | 2.  |
|                   | 3.  |
PLEASE DO NOT USE THIS PAGE
R2101

PLANT CLASSIFICATION, STRUCTURE & FUNCTION

Level 2

Monday 24 June 2019

Candidates Registered 451
Candidates Entered 380 84% Passed with Commendation 147 39%
Candidates Absent/Withdrawn 65 15% Passed 134 35%
Candidates Deferred 6 1% Failed 99 26%

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) Name **TWO** monocotyledonous and **TWO** dicotyledonous plants:

Monocotyledonous plants:

Dicotyledonous plants:

b) State **ONE** difference between monocotyledonous and dicotyledonous plants for **EACH** of the organs listed, by completing the table below:

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<td></td>
<td></td>
</tr>
<tr>
<td>Roots</td>
<td></td>
<td></td>
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Q1a) Most candidates were able to give the full botanical names for two monocotyledonous plants e.g. *Narcissus pseudonarcissus*, *Stipa gigantea* and two dicotyledonous plants e.g. *Quercus robur*, *Alchemilla mollis* and were awarded full marks.

Candidates who misread the question and gave examples of angiosperms and gymnosperms could not be awarded any marks.

Q1b) The best candidates who gained full marks chose a specific difference between monocotyledonous and dicotyledonous plants for each of the organs and recorded the two parts of the comparison in the columns provided. These included:

**Flowers** – Monocotyledonous flower parts are in multiples of 3 and have tepals whereas dicotyledonous flowers are in multiples of 4 or 5 and have distinct petals and sepals.

**Leaves** – Monocotyledonous leaves have smooth margins, are lance shaped or blade like, have parallel venation, no petiole and are simple with their stomata evenly distributed on their upper and lower surface.

Dicotyledonous leaves have a range of margins e.g. serrate, wavy, have various shapes e.g. palmate, ovate and can be described as ‘broadleaved’. Dicotyledonous leaves also have various venations, they can be simple or compound, generally have petioles and have more stomata on the underside than on the upper surface.

Candidates who made reference to cotyledons or ‘seed leaves’ could not gain any marks as they are not true leaves.

**Roots** – Monocotyledonous plants have a fibrous root system which is adventitious and polyarch (many arms) to their xylem system and the pith may persist.

Dicotyledonous plants often have a central tap root which is derived from the radicle of the seed with laterals branching from it. Dicotyledonous plants can also have a fibrous root system. The roots of dicotyledonous plants have star-shaped xylem tissue and no pith.
Q2 a) Describe what is meant by EACH of the following terms in relation to water movement in a plant:

i) osmosis

ii) diffusion

b) State FOUR functions of water in a plant.

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

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

ii) Diffusion is the movement of water molecules from an area of high water concentration to an area of low concentration e.g. loss of water vapour from the leaves in transpiration.

Q2b) Maximum marks were gained by candidates who were able to state specific functions of water in a plant including water:

• Creates cell turgor which enables cell expansion
• Controls the opening and closing of the stomata
• Supports herbaceous plants
• Enables the uptake and transport of minerals and sugars
• Is used in photosynthesis
• Dissolves substances e.g. Enzymes so that they can take part in reactions
• Is essential in triggering germination
Q3 a) State **ONE** difference between a woody and a herbaceous stem.

b) Name **ONE** woody and **ONE** herbaceous plant:

Woody plant name:

Herbaceous plant name:

Q3a) Candidates who stated the difference between a woody and herbaceous stem by giving both halves of the comparison gained maximum marks. Suitable answers included:

- Woody stems undergo secondary thickening whereas herbaceous stems do not
- Woody stems develop bark (cork cambium) whereas herbaceous stems retain an epidermis
- Woody stems have a central cylinder of xylem and phloem whereas herbaceous stems have xylem and phloem arranged in a ring of vascular bundles

Q3b) Most candidates were able to name a woody and a herbaceous plant and were awarded full marks. Acceptable answers included:

**Woody Plant** – *Quercus robur, Choisya ternata*

**Herbaceous Plant** – *Digitalis purpurea, Anemone x hybrida*

Question 3 continues on the facing page
c) Label the following features of a woody stem on the diagram below:

   vii) axillary bud;  
   viii) node;  
   ix) girdle scar;  
   x) apical bud;  
   xi) lenticel;  
   xii) leaf scar.

   A typical woody dicotyledonous stem

Q3c) Candidates who clearly attached the labels to the relevant part of the diagram achieved full marks.

   It is important to note that the node refers to the section of stem adjacent to where the leaf is attached.

   Candidates who confused the apical and axillary buds could not be awarded any marks.
Q4 a) Name the term used to describe the storage of starch over winter for new plant growth in the spring.

b) Describe THREE distinct plant adaptations for the storage of starch and give a NAMED plant example for EACH, by completing the table below:

<table>
<thead>
<tr>
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</table>

Q4a) The majority of candidates correctly named 'perennation' as the term which describes the storage of starch over winter and gained full marks.

Q4b) To achieve maximum marks candidates were required to describe distinct plant adaptations for the storage of starch. Suitable examples included:

- **Bulb** which has swollen leaf scales e.g. *Narcissus pseudonarcissus*
- **Corm** which is a stem e.g. *Crocus tommasinianus*
- **Swollen/enlarged tap root** which is a root e.g. *Daucus carota*
- **Rhizome** which is a stem e.g. *Iris laevigata*,
- **Tuber** which is a root e.g. *Dahlia ‘Bishop of Llandaff’*
- **Tuber** which is a stem e.g. *Solanum tuberosum*
Q5 a) Name the site where photosynthesis takes place in a plant cell.

b) State the role of chlorophyll in photosynthesis.

c) Describe how EACH of the following environmental factors affect the rate of photosynthesis:

   i) availability of mineral nutrients
   ii) temperature

Q5a) Most candidates correctly named the site where photosynthesis takes place in a plant cell as the chloroplast and were awarded full marks.

Q5b) Candidates who gained maximum marks correctly stated that chlorophyll absorbs or captures light of specific wavelengths (red and blue) known as photosynthetically active radiation (PAR) which is used in photosynthesis.

Q5c) The best candidates described how each of the environmental factors affected the rate of photosynthesis and achieved full marks. Suitable answers included:

   **Availability of mineral nutrients** – a lack of nutrients reduces the rate of photosynthesis and can cause chlorosis whereas too high a level of nutrients can reduce photosynthesis due to plasmolysis of the cells. Magnesium which is a constituent of chlorophyll causes yellowing of the leaf (chlorosis) if there is a lack of it and nitrogen is essential for enzymes catalysing the process.

   **Temperature** – increases the rate of photosynthesis to an optimum i.e. 15 - 35°C or maximum temperature above 35°C . The denaturation of enzymes takes place at high temperatures. Wilting at high temperatures reduces photosynthesis as there is less light interception and the stomata also close which reduces carbon dioxide uptake as photosynthesis does not take place.
Q6

a) State ONE difference between a fruit and a seed.  
   2

b) Describe TWO distinct mechanisms by which seeds are dispersed by wind, giving a NAMED plant example for EACH mechanism.  
   2

    Dispersal method 1:  
    Plant example:  
    1

    Dispersal method 2:  
    Plant example:  
    1

c) Name TWO seed dispersal mechanisms other than wind.  
   2

Q6a) The majority of candidates either stated that the seed is an ovule and the fruit is the mature ovary, following fertilisation or that the seed contains the plant embryo and the fruit contains the seed and were awarded full marks.

Q6b) Full marks were gained by candidates who provided good descriptions of mechanisms by which seeds are dispersed by wind. Acceptable answers included:

   - A blade or wing which spins or has a ‘helicopter’ action e.g. *Acer palmatum*
   - Parachutes which have feathery appendages and light seeds which drift on wind currents e.g. *Taraxacum officinale*
   - Censer mechanisms where the wind shakes the pedicel and seeds are dispersed through pores in the fruit e.g. *Papaver somniferum*

Q6c) Most candidates named animal attachment, animal ingestion/frugivory and animal hoarding but water and self/explosive seed dispersal mechanisms were also acceptable for maximum marks.
Q7  a) State what is meant by the term ‘plant tissue’.

  b) For EACH type of plant tissue listed below, give:

   i) TWO structural characteristics;

   ii) TWO functions.

by completing the table below.

<table>
<thead>
<tr>
<th>Plant tissue</th>
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<th>Functions</th>
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<tbody>
<tr>
<td>Epidermis</td>
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<tr>
<td></td>
<td>2.</td>
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<td>Parenchyma</td>
<td>1.</td>
<td>1.</td>
</tr>
<tr>
<td></td>
<td>2.</td>
<td>2.</td>
</tr>
</tbody>
</table>

Q7a) Candidates who stated that a plant tissue is a group of cells performing a specific function or purpose achieved full marks.

Q7b) Maximum marks were gained by candidates who were able to give suitable structural characteristics and functions of specific plant tissues. Acceptable answers included:

**Epidermis** – Structurally it is a transparent, single layer of flattened cells, usually without chloroplasts which are tightly packed together. Epidermis has a surface layer of wax called the cuticle. It may contain modified cells such as guard cells, hairs or root hairs.

Its functions include prevention of water loss, gas exchange through stomata, protection from pests, diseases and physical damage, containment of underlying tissues and it may have specialised functions e.g. defence (stinging hairs) or increasing water uptake (root hairs).

**Parenchyma** – Structurally it is made up of cells which are generally rounded, with air spaces between them, thin cell walls and large vacuoles.

Its function is to act as a ‘packing’ tissue, to support the plant through turgor and it may have specialised functions e.g. starch storage, photosynthesis as in the mesophyll of the leaf or buoyancy in aquatic plants.
Q8 a) Draw a labelled diagram of a typical monocotyledonous flower in the space below:

Section through a typical monocotyledonous flower

b) State the function of THREE of the structures labelled in a).

Q8a) The best candidates drew diagrams which were easily identifiable as monocotyledonous flowers and were awarded full marks. The key feature is that they have tepals instead of separate petals and sepals. Acceptable features where the label clearly touched the relevant part of the diagram included: tepals, anther, filament, stigma, style, ovule, ovary, receptacle, pedicel and nectary.

Q8b) Full marks were awarded to candidates who were able to state the function of the structures of a monocotyledonous flower. Suitable answers included:

- Tepal attracts pollinators or protects internal structures
- Stigma receives pollen
- Style holds the stigma in the best position to receive pollen
- Ovary contains ovules and becomes the fruit
- Ovule contains the female gamete (ovum) and the embryo after fertilisation and becomes the seed
- Anther contains pollen which is the male gamete
- Filament holds the anther in the best position for pollen dispersal
- Receptacle attaches the flower parts
- Pedicel holds the flower in the best position for pollination and seed dispersal
- Nectary produces nectar to attract pollinators into the flower
Q9 a) State using words the basic equation for aerobic respiration.

b) State how the rate of aerobic respiration affects the length of time that seeds can be stored.

c) Describe how TWO distinct environmental factors are controlled to extend the length of time seeds can be stored.

Q9a) Most candidates correctly stated that the equation for aerobic respiration is where oxygen and glucose combine to form carbon dioxide, water and energy/ATP and achieved maximum marks.

Q9b) Candidates who stated that increasing the rate of respiration will decrease the length of time that seeds can be stored (or the reverse) were awarded full marks.

Q9c) To gain maximum marks candidates were required to describe how environmental factors are controlled to extend the length of time seeds can be stored. Suitable answers included:

**Temperature** – Reducing temperature reduces respiration which increases the storage time of seeds e.g. storing seeds at 5°C by refrigeration. Orthodox seeds can be stored at much lower temperatures in a seed bank.

**Oxygen or Carbon Dioxide** – Reducing oxygen or increasing carbon dioxide in the storage atmosphere reduces the respiration rate which increases the storage time of seeds. This can be achieved by storing seeds in vacuum sealed packages or in sealed containers with the addition of carbon dioxide or nitrogen.

**Humidity** – Reducing the humidity in the store increases the storage time of seeds. This can be achieved by drying the seeds before they are stored and storing them in sealed containers with silica gel. Orthodox seeds require a moisture content of less than 5% and recalcitrant seeds require higher moisture contents.
Q10 a) State the difference between a tap root and a lateral root.

Describe EACH of the following root features by completing the table below:

<table>
<thead>
<tr>
<th>Root features</th>
<th>Characteristic</th>
</tr>
</thead>
<tbody>
<tr>
<td>Zone of differentiation</td>
<td>1.</td>
</tr>
<tr>
<td>Pericycle</td>
<td>1.</td>
</tr>
<tr>
<td>Root hair</td>
<td>1.</td>
</tr>
<tr>
<td>Root cap</td>
<td>1.</td>
</tr>
</tbody>
</table>

Q10a) The majority of candidates who achieved full marks correctly stated that a tap root is a single, main or central root whereas lateral roots branch from it. The best answers also stated that tap roots arise from the radicle and are primary roots whereas lateral roots arise from the pericycle and are secondary roots.

Q10b) Maximum marks were awarded to candidates who were able to describe specific root features. Acceptable answers included:

**Zone of differentiation** – is above the zone of elongation. It is the area where cells differentiate into their final forms and become specialised e.g. epidermis, xylem, root hairs.

**Pericycle** – is a layer between the endodermis and the xylem and phloem which it surrounds. It becomes meristematic and produces lateral roots. It is also the outer layer of the stele.

**Root hairs** – are single, elongated epidermal cells which increase the surface area for the uptake of water and minerals. Root hairs are positioned close to the root tip in the zone of differentiation.
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