Including Examiners comments

RHS
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R2101

PLANT CLASSIFICATION, STRUCTURE & FUNCTION

Level 2

Monday 10 February 2020

09:30 – 10:50

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.

Ofqual Unit Code K/505/2967

Please turn over/…..

ANSWER ALL QUESTIONS

MARKS

Q1 a) State what is meant by the following botanical terms giving a **NAMED** plant example for **EACH** by completing the table below:

Botanical Term	**Meaning**	**Plant example**	
ephemeral			**2**
annual			**2**
biennial			**2**
perennial			**2**

b) State **ONE** difference between the juvenile and the adult stage of the plant life cycle. **2**

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Total Mark

Please see over/…..

MARKS

Q2 a) Draw a fully labelled cross section of a young dicotyledonous root. **7**

Young dicotyledonous root

b) Indicate with a line where **EACH** of the following processes takes place on the diagram above: **3**

i) sugar transport
ii) selection of minerals
iii) production of lateral roots

Total Mark

Please turn over/…..

MARKS

Q3 a) State **ONE** function for **EACH** of the flower parts by completing the table below:

Flower part	**Function**	
anther		**1**
petal		**1**
ovule		**1**
stigma		**1**

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

i) corolla..... **1**

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ii) calyx..... **1**

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c) Describe **TWO** differences between monocotyledonous and dicotyledonous flowers.

monocotyledonous..... **2**

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dicotyledonous..... **2**

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Total Mark

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MARKS

Q4 a) Describe what is meant by the Law of Limiting Factors. **3**

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

i) light intensity **3**
ii) water supply **4**

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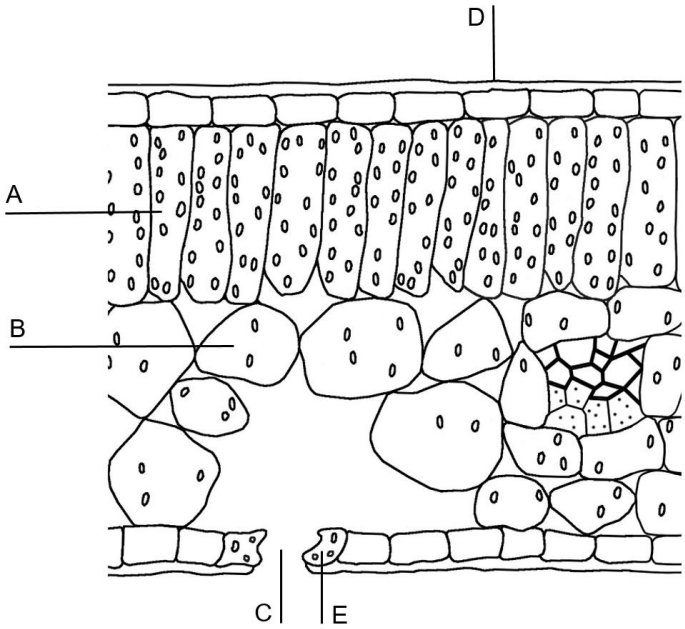
MARKS

Q5 a) Name **EACH** of the features labelled A-E on the diagram below: **5**

<u>Cross section of a dicotyledonous leaf</u>



b) State **ONE** function for **EACH** of the features labelled on the diagram above.

A..... **1**

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B..... **1**

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C..... **1**

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D..... **1**

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E..... **1**

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Total Mark

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MARKS

Q6 a) Describe **THREE** distinct adaptations for protection **OR** defence, giving a **NAMED** plant example for **EACH,** by completing the table below:

Name of plant adaptation	**Plant part adapted**	**Plant example**	
1.			**3**
2.			**3**
3.			**3**

b) Name **ONE** other plant adaptation. **1**

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Total Mark

Please turn over/…..

Q7 a) Describe the process of pollination. **MARKS 3**

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b) List **SIX** characteristics of a wind-pollinated flower. **6**

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c) Name **ONE** plant that is wind-pollinated. **1**

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Total Mark

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Q8 a) List the products of aerobic respiration. **MARKS**

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b) Name the site of aerobic respiration in the cell. **1**

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c) State how the rate of aerobic respiration affects seed storage. **1**

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d) Describe how the following environmental factors can be manipulated to increase seed storage times:

i) oxygen..... **2**

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ii) temperature..... **3**

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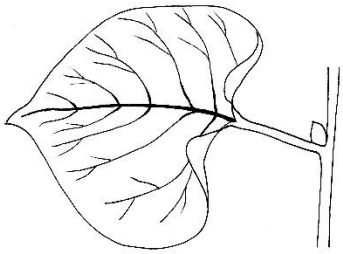
Total Mark

Please turn over/…..

Q9 a) Label **EACH** of the following features on the diagram below: **MARKS**

i) midrib **1**
ii) lamina **1**
iii) vein **1**
iv) petiole **1**

<u>A simple dicotyledonous leaf and stem</u>



b) Describe, with the use of a labelled diagram, **TWO NAMED** compound leaf arrangements.

1. **NAMED** example **3**

2. **NAMED** example **3**

Total Mark

Please see over/…..

MARKS

Q10 a) Name **ONE** conifer. **1**

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b) List **SIX** distinct characteristics of conifers. **6**

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c) State **THREE** ways in which flowering plants differ from conifers. **3**

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Total Mark

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Inspiring everyone to grow

R2101

PLANT CLASSIFICATION, STRUCTURE & FUNCTION

Level 2

Monday 10 February 2020

Candidates Registered	**1222**		**Total Candidates Passed**	**806**	**80%**
Candidates Entered	1010	83%	Passed with Commendation	441	44%
Candidates Absent/Withdrawn	159	13%	Passed	365	36%
Candidates Deferred	53	4%	Failed	204	20%

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 following botanical terms giving a **NAMED** plant example for **EACH** by completing the table below:*

Botanical Term	***Meaning***	***Plant example***	
ephemeral			***2***
annual			***2***
biennial			***2***
perennial			***2***

*b) State **ONE** difference between the juvenile and the adult stage of the plant life cycle.* ***2***

Q1a) Candidates who were able to give precise meanings of the botanical terms including examples were awarded full marks. These included:

Ephemeral is a plant which completes several life cycles in one year or season e.g. *Senecio vulgaris, Capsella bursa-pastoris.*

Annual completes its life cycle in one year or season e.g. *Helianthus annuus, Zea mays.*

Biennial completes its life cycle in two years or seasons. It grows vegetatively in the first year and produces flowers and seeds in the second year before dying e.g. true biennials include *Daucus carota, Dipsacus fullonum.*

Examples of plants which are grown as biennials were not acceptable.

Perennial has a life cycle which lasts longer than two years e.g. *Quercus robur, Bellis perennis.*

Q1b) Candidates who gained full marks stated that the juvenile stage in the plant life cycle is non flowering, where plants do not reproduce sexually as they only grow vegetatively, whereas the adult stage in the plant life cycle is where flowers and seeds are produced and plants reproduce sexually.

MARKS

Q2 *a) Draw a fully labelled cross section of a young dicotyledonous root.* ***7***

<u>Young dicotyledonous root</u>

b) Indicate with a line where ***EACH*** *of the following processes takes place on the diagram above:* ***3***

i) sugar transport
ii) selection of minerals
iii) production of lateral roots

Q2a) The best candidates drew a clearly identifiable cross section (transverse section) across a young dicotyledonous root and gained maximum marks. Acceptable features where the label clearly touched the edge or centre of the relevant part of the diagram included the epidermis, (with root hairs if drawn), cortex, endodermis, pericycle, phloem, vascular cambium and xylem.

Marks were also awarded, where the full extent of the stele and the position of the casparian strip within the endodermis were clearly indicated.

Candidates who drew a diagram of a stem could not be awarded any marks.

Q2b) To gain maximum marks candidates were required to indicate where specific processes take place in a young dicotyledonous root. Suitable answers included:

- Sugar transport takes place in the phloem
- Selection of minerals takes place at the root hair
- The epidermis, the endodermis and lateral roots are produced by the pericycle

MARKS

Q3 *a) State **ONE** function for **EACH** of the flower parts by completing the table below:*

Flower part	***Function***	
anther		***1***
petal		***1***
ovule		***1***
stigma		***1***

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

i) corolla ***1***

ii) calyx ***1***

*c) Describe **TWO** differences between monocotyledonous and dicotyledonous flowers.*

monocotyledonous ***2***

dicotyledonous ***2***

Q3a) Full marks were awarded to candidates who were able to state the function for each flower part. Suitable answers included:

- Anther produces or contains pollen
- Petal attracts pollinators or can provide a landing pad for bees
- Ovule becomes the seed or is the site of fertilisation or contains the female gamete (ovum)
- Stigma receives the pollen

Q3b) Candidates who gave accurate meanings of the specific terms achieved full marks. These included:

i) **Corolla** is the collective term for all of the petals of a flower.
ii) **Calyx** is the collective term for all of the sepals of a flower.

Q3c) The majority of candidates were able to describe differences between monocotyledonous and dicotyledonous flowers. The best candidates were able to give direct comparisons and achieved maximum marks.

Monocotyledonous flower parts are in multiples of 3 and have tepals rather than differentiated petals and sepals.

Dicotyledonous flower parts are in multiples of 4 and 5 and have distinct petals and sepals.

		MARKS
Q4 *a)*	*Describe what is meant by the Law of Limiting Factors.*	***3***
b)	*Describe how the following environmental factors affect the rate of photosynthesis:*	
	i) light intensity	***3***
	ii) water supply	***4***

Q4a) Candidates who clearly described what is meant by the Law of Limiting Factors and the concept of 'rate limiting factors' were awarded full marks for the following points:

- Where a process has more than one input or starting material
- The rate of the process will be limited by the one factor
- Which is least available (even though there is an unlimited supply of the other factors)

Full marks were also gained by candidates who used an example to illustrate this concept e.g. photosynthesis. They described how if light levels are low, the rate of the process will be limited even though plenty of carbon dioxide and a suitable temperature are available.

Q4b) i) **Light Intensity** - Most candidates were able to describe that the rate of photosynthesis increases with a greater light intensity up to a certain light level or optimum (or the reverse statement).

The best candidates who gained maximum marks described how the rate eventually levels off as light intensity is increased (the light saturation point). No photosynthesis takes place in the dark or at very low light levels as the stomata close and carbon dioxide is not taken in. Equally, at very high light intensities chlorophyll/chloroplasts can be damaged reducing the rate of photosynthesis.

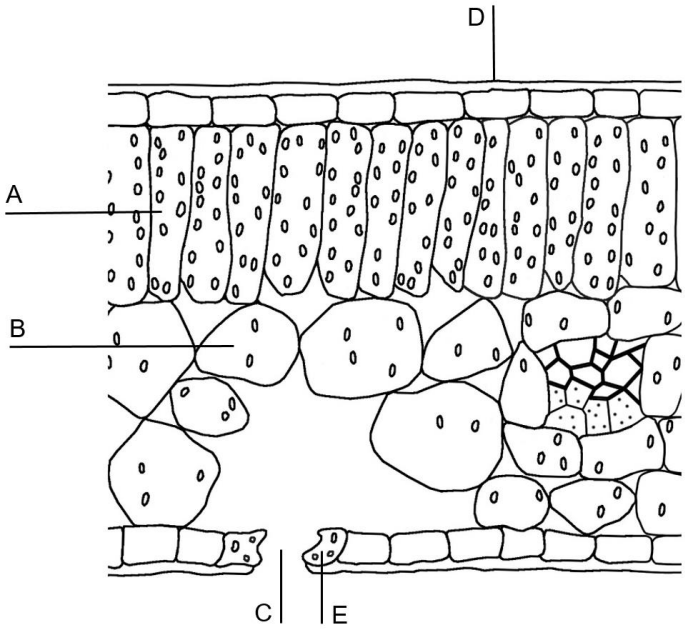
ii) **Water Supply** – Maximum marks were gained by candidates who understood that it is the effect of reduced water supply causing stomatal closure and therefore limiting carbon dioxide uptake, which is most important.

Chloroplasts will always have enough water as a raw material for photosynthesis even if it is in short supply to the plant. Similarly, reduced water supply will not limit mineral uptake sufficiently to reduce photosynthesis. As well as stomatal closure, insufficient water will also cause leaves to wilt through loss of turgor reducing light interception and therefore reducing the rate of photosynthesis.

MARKS

Q5 *a) Name **EACH** of the features labelled A-E on the diagram below:* ***5***

<u>Cross section of a dicotyledonous leaf</u>



*b) State **ONE** function for **EACH** of the features labelled on the diagram above.*

A ***1***

B ***1***

C ***1***

D ***1***

E ***1***

Q5a) Most candidates were able to correctly identify the labels on the cross section of a dicotyledonous leaf and were awarded full marks. Acceptable answers were:

A – Palisade mesophyll layer

B – Spongy mesophyll layer

C – Stoma or plural stomata

D – Cuticle

E – Guard cell

Q5b) Maximum marks were achieved by candidates who were able to state the function of each of the features of a dicotyledonous leaf named above. Suitable answers included:

Palisade Mesophyll Layer – Site of photosynthesis

Spongy Mesophyll Layer – Site of photosynthesis. Air spaces in the spongy mesophyll layer facilitate gas exchange and store carbon dioxide. The cells may also store starch.

Stoma – Site of entry of carbon dioxide and release of oxygen (gas exchange) and transpirational water vapour loss.

Cuticle – Waterproofing waxy layer which reduces water loss and protects from pest and disease damage.

Guard Cell – Controls the opening and closing of the stoma and controls water loss.

MARKS

Q6 *a) Describe **THREE** distinct adaptations for protection **OR** defence, giving a **NAMED** plant example for **EACH,** by completing the table below:*

Name of plant adaptation	***Plant part adapted***	***Plant example***	
1.			***3***
2.			***3***
3.			***3***

*b) Name **ONE** other plant adaptation.* ***1***

Q6a) To gain maximum marks candidates were required to describe distinct plant adaptations for protection or defence. Suitable examples included:

Spine/Spiny Bracts which is an adapted leaf, stipule or bract e.g. *Berberis thunbergii, Euphorbia horrida.*

Prickle which is an outgrowth of the epidermis on stems and leaves e.g. *Rosa rugosa, Rubus fruticosa.*

Thorn/Stem Spine which is an adapted stem, shoot or branch e.g. *Prunus spinosa, Pyracantha* 'Orange Charmer'.

Stinging Hairs found on the leaf, stem or epidermis e.g. *Urtica dioica, Euphorbia robbiae.*

Q6b) The majority of candidates were able to name a plant adaptation and were awarded full marks. Suitable answers included:

swollen tap root, tendril, bulb, corm, tuber.

Q7 ***MARKS***

a) *Describe the process of pollination.* ***3***

b) *List **SIX** characteristics of a wind-pollinated flower.* ***6***

c) *Name **ONE** plant that is wind-pollinated.* ***1***

Q7a) The best candidates provided a clear description of pollination which is the transfer of pollen from the anther to the stigma and achieved full marks.

Candidates who described fertilisation could not be awarded any marks.

Q7b) Candidates who were able to provide suitable characteristics of a wind pollinated flower were awarded full marks. These included:

- Small petals, tepals or bracts
- Petals, tepals or bracts are often green or brown in colour
- The stigma is feathery
- The stigma hangs or dangles outside the flower
- The stamen/anther hangs or dangles outside the flower
- Pollen is produced in very large quantities
- Pollen grains are small or lightweight
- Pollen grains are smooth or winged or may possess air bladders

Q7c) Most candidates named a suitable plant which is wind pollinated and achieved maximum marks. Suitable answers included:

Corylus avellana, Zea mays, Poa annua, Betula pendula, Pinus sylvestris.

		MARKS
Q8 *a)*	*List the products of aerobic respiration.*	***3***
b)	*Name the site of aerobic respiration in the cell.*	***1***
c)	*State how the rate of aerobic respiration affects seed storage.*	***1***
d)	*Describe how the following environmental factors can be manipulated to increase seed storage times:*	
	i) oxygen	***2***
	ii) temperature	***3***

Q8a) The products of aerobic respiration were correctly named as; carbon dioxide, water and energy or ATP by most candidates who gained maximum marks.

Q8b) Candidates who named the mitochondria or mitochondrion as the site of aerobic respiration were awarded full marks.

Q8c) Candidates who stated that the higher the rate of respiration the shorter the storage time (or the reverse) achieved full marks.

Q8d) To gain maximum marks candidates were required to describe how specific environmental factors can be manipulated to increase seed storage times. Suitable answers included:

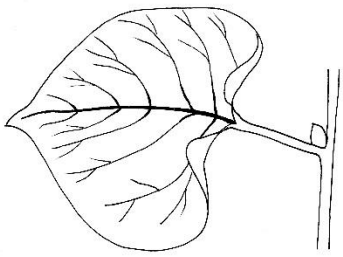
i) **Oxygen** – Reducing the concentration of oxygen increases the length of time seeds can be stored as the rate of aerobic respiration is reduced. This can be achieved by vacuum packing seeds, storing them in air tight containers (where respiration uses up the oxygen in the container) or adding carbon dioxide or nitrogen to replace the oxygen in seed stores.

ii) **Temperature** – Reducing the temperature increases the time that seeds can be stored as the rate of aerobic respiration is reduced. This can be achieved by providing refrigeration below 5°C, using liquid nitrogen to provide temperatures down to -196°C or freezing to provide temperatures down to -20°C for some seed.

Q9 *a) Label **EACH** of the following features on the diagram below:* ***MARKS***

i) midrib ***1***
ii) lamina ***1***
iii) vein ***1***
iv) petiole ***1***

<u>A simple dicotyledonous leaf and stem</u>



*b) Describe, with the use of a labelled diagram, **TWO NAMED** compound leaf arrangements.*

*1. **NAMED** example .....* ***3***

*2. **NAMED** example .....* ***3***

Q9a) Candidates who clearly attached the labels to the relevant part of the diagram achieved full marks.

Q9b) Full marks were gained by candidates who provided good descriptions of compound leaves. These are made up of leaflets joined to a rachis supported by a petiole with an axillary bud at the point where it joins the stem.

Suitable types of compound leaves which were described included: pinnate, bipinnate, palmate and trifoliate.

The best candidates drew the correct arrangement and labelled the leaflets, petiole and axillary buds to show an understanding of the specific leaf structure.

		MARKS
Q10 *a)*	*Name **ONE** conifer.*	***1***
b)	*List **SIX** distinct characteristics of conifers.*	***6***
c)	*State **THREE** ways in which flowering plants differ from conifers.*	***3***

Q10a) The majority of candidates were able to name a conifer and gained full marks. Acceptable answers included:

Chamaecyparis lawsoniana, Pinus sylvestris, Thuja plicata.

Q10b) Maximum marks were gained by candidates who were able to list distinct characteristics of conifers which included:

- Naked seed
- Wind pollinated
- Woody plants or plants which undergo secondary thickening or trees and shrubs
- Perennial life cycle
- Generally evergreen (some conifers are deciduous)
- Reduced leaves in the form of needles or scale leaves
- Wind dispersal of seed
- Production of resin

Q10c) Candidates who clearly stated ways in which flowering plants differ from conifers were awarded full marks. These included:

- The seed of flowering plants is enclosed within a fruit
- Pollination of flowering plants can be carried out by a range of agents e.g. insects, birds, wind, water
- Flowering plants may have a woody structure but can also be herbaceous or they may or may not undergo secondary thickening
- Flowering plants have a range of life cycles e.g. ephemeral, annual, biennial, perennial
- Flowering plants can be evergreen or deciduous
- Flowering plants have a range of leaf shapes e.g. palmate, pinnate, lanceolate, obovate

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