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R3101

PLANT TAXONOMY, STRUCTURE & FUNCTION

Level 3

Wednesday 21 June 2023

09:00 – 10:40

Written Examination

Candidate Number: .....

Candidate Name: .....

Centre Name: .....

IMPORTANT – Please read carefully before commencing:

i) The duration of this paper is **100** 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 M/505/2966

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ANSWER ALL QUESTIONS

MARKS

Q1 a) Explain using **ONE NAMED** plant example, how specific epithets can indicate:

i) plant origin **3**

ii) plant habitat. **3**

Please see over/…..

MARKS

b) State the difference between a subspecies and a forma giving a **NAMED** plant example for each. **4**

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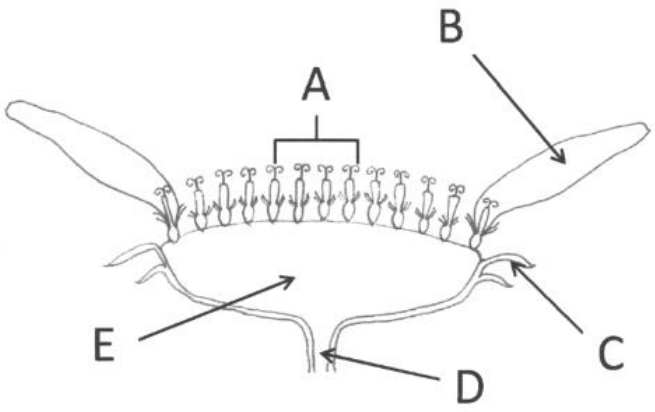
Total Mark

Please turn over/…..

MARKS

Q2 a) The diagram below shows the typical inflorescence found in Asteraceae.

Name the features labelled A-E on the diagram: **5**



A……

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B……

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C……

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D……

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E……

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Please see over/…..

MARKS

b) Name the inflorescence shown in a). **1**

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c) State how the inflorescence shown in a) encourages effective pollination by butterflies. **4**

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Total Mark

Please turn over/…..

MARKS

Q3 a) State what is meant by the term ‘transpiration’. **1**

b) Explain how **THREE** distinct structural features of a leaf of *Pinus sylvestris* reduce transpirational water loss. **9**

Please see over…..

Please turn over/…..

Total Mark

MARKS

Q4 a) Describe the development of a true fruit following fertilisation. **4**

Please see over/…..

MARKS

b) State **ONE NAMED** plant example and **TWO** structural characteristics for **EACH** of the dry fruit categories below**:**

i) nut **3**
ii) follicle **3**

by completing the table below.

Dry fruit	**NAMED plant example**	**Characteristic**
Nut		**1.**
		2.
Follicle		**1.**
		2.

Total Mark

Please turn over/…..

Q5 a) Describe the formation of the periderm (outer bark) in a woody stem.

MARKS
4

Please see over/…..

		MARKS
b)	Describe the characteristics of cells in **THREE** tissue layers of the periderm.	**6**

Total Mark

Please turn over/…..

MARKS

Q6 Land plants are thought to have evolved from aquatic algae.

Explain how **FIVE** distinct characteristics of angiosperm **stems** have enabled them to live on land. **10**

Please see over/…..

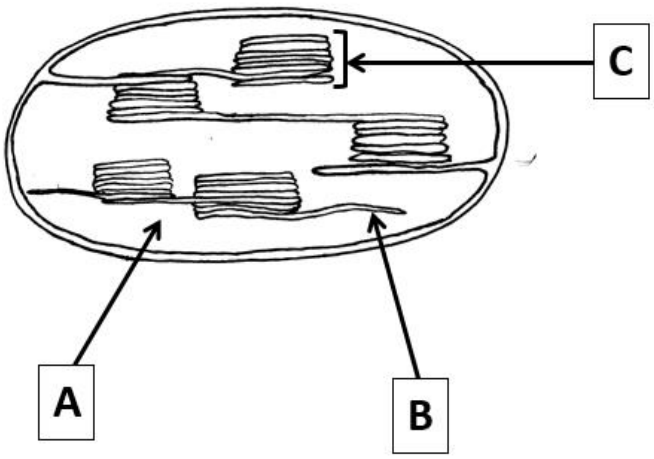
Total Mark

Please turn over/…..

MARKS

Q7 a) Name the structures labelled A-C on the diagram below: **3**

Structure of a chloroplast



A……

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B……

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C……

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Please see over/…..

MARKS

b) Describe the photosynthetic processes which take place on structures A and B in the diagram in a)

4

Structure A

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3

Structure B

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Total Mark

Please turn over/…..

MARKS

Q8 a) *Malus* cultivars (apple) are generally obligate cross pollinated plants.

i) State **TWO** benefits of cross pollination to the plant. **2**

ii) Describe **FOUR** methods growers use to optimise pollination in apple orchards. **8**

Please see over/…..

Total Mark

Please turn over/…..

MARKS

Q9 a) Define what is meant by the following terms, giving a **NAMED** plant example for **EACH,** by completing the table below:

Term	Definition	Plant example
Short day plant		
Long day plant		
Day neutral plant		

2

2

2

Please see over/…..

b) State how gibberellin affects flowering when applied to plants. **MARKS**

3

c) State what is meant by the term ‘florigen’.

1

Total Mark

Please turn over/…..

Q10 a) Describe the transport of sucrose from a leaf to a root under **EACH** of the following headings:

MARKS

i) phloem loading **3**
ii) passage in the phloem **2**
iii) phloem unloading **1**

Please see over/…..

MARKS

b) Explain how **TWO** features of sieve tube cells optimise sucrose transport. **4**

Total Mark

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DO NOT USE THIS PAGE

R3101

PLANT TAXONOMY, STRUCTURE & FUNCTION

Level 3

Wednesday 21 June 2023

Candidates Registered	**74**		**Total Candidates Passed**	33	54%
Candidates Entered	61	82%	Passed with Commendation	11	18%
Candidates Absent/Withdrawn	8	11%	Passed	22	36%
Candidates Deferred	5	7%	Failed	28	46%

General comments

Where a plant example is chosen, it is important to write the FULL botanic name and not just a partial name, following the correct naming protocols. Where named plant examples are required, common names are not credited at Level 3.

Spellings of scientific terms and botanic plant names need to be full and accurate - poor spellings may be penalized.

Questions - It is essential to read the question carefully and to note the **key words** before starting to write to ensure answers are relevant. Candidates should take account of the command statements in the question e.g. 'list', 'describe', 'explain', together with the mark allocation, to judge the depth of the answer required. Extra information, even if it is accurate, does not gain extra marks.
Where a number of answers were specified in the question and a candidate gave a list with more than that number, **only the first answers** in the list were marked, e.g. where the question stated 'Name **TWO** locations' or 'State **TWO** ways' only the first **TWO** answers were marked even if the correct answers were given further down. It is helpful (but not essential) if the answers are numbered in the text or separate paragraphs or bullet points are used.

Plant names - Where named plant examples were asked for, **full botanical names are required** to achieve full marks: genus, species and where appropriate variety, cultivar etc. needed to be written and spelt correctly. Where genus alone was given, all species in that genus need to show the characteristic asked for to gain any credit. **Common names were NOT accepted** and misspellings were penalised. Candidates needed to use unambiguous plant examples from sources such as the RHS Plant Finder and/or the RHS A-Z Encyclopaedia of Plants together with examples given in the syllabus and avoid obscure or difficult to verify plant examples, which risked being not credited.

Labels on diagrams must be carefully and correctly positioned to avoid ambiguity. Marks can be easily lost if this is not followed. Labels must actually touch the appropriate part of the diagram and must not be left hanging in mid air. Annotations on diagrams can be accepted as an alternative to description in the text as long as these are clear and answer the question. No marks were awarded for artistic merit or for unlabelled diagrams.

Continuation sheets - Where these have been included, it is vital that the relevant question number is included in the left hand margin if information written here is to be considered. These should also be attached to the answer booklet in the appropriate place and candidates should indicate in their answer booklet that they have written part of their answer on the attached sheet/s.

Q1 **a)** Explain using **ONE NAMED** plant example, how specific epithets can indicate:

i) plant origin

ii) plant habitat

b) State the difference between a subspecies and a forma giving a **NAMED** plant example for each

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Q1 a) Candidates who scored highly gave a full botanic plant name written and spelt correctly, not just the specific epithet alone.

i) popular plant origin responses:
Fatsia japonica where the specific epithet *japonica* means 'from Japan' or
Cercis canadensis which indicates that the species originates in Canada.
For full marks some explanation was required, e.g., the plant might well thrive in climate conditions similar to those found in their country of origin- in this case withstanding low winter temperatures

ii) Some candidates misread 'habitat' as 'habit', and gave examples such as *Cotoneaster horizontalis,* so no marks could be awarded.
Common plant habitat answers were '*sylvatica'* meaning 'of the woods or forests' and can therefore indicate that the plant should thrive in a woodland setting, '*palustris*' meaning 'of the marshes' so therefore it might thrive in damp conditions and '*alpina'* meaning 'from the alpine regions/ from above the treeline in the mountains' so the plant is likely to be suitable for growing on a rockery.

b) Although most candidates indicated that both were variants of a species, it was apparent that many candidates were not familiar with the taxonomic hierarchy and how this relates to variation from the species:

Candidates struggled to state one difference between subspecies and forma. Since they were asked to give a difference between subspecies and forma, there needed to be a comparison for full marks
e.g., Subspecies differ widely from the original species whereas forma differ only slightly; subspecies have evolved due to wide geographical separation from the original species whereas forma are found within the same population or location; subspecies show many genetic mutations from the original species whereas forma have fewer mutations.
Some candidates could give suitable examples for a plant subspecies and a plant forma using the correct naming protocols although some gave cultivar names or varietas names instead and could not be rewarded.

Correct examples for subspecies included *Euphorbia characias* subsp. *wulfenii*; *Daucus carota* subsp. *carota*; *Hydrangea anomala* subsp. *petiolaris*

And for forma, *Digitalis purpurea* f. *albiflora*, *Juncus effusus* f. *spiralis; Berberis thunbergia* f. *atropurpurea.*
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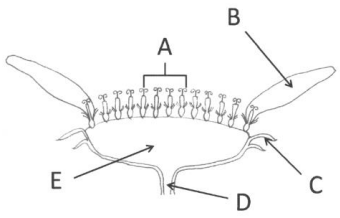
Q2 **a)** The diagram below shows the typical inflorescence found in Asteraceae. Name the features labelled A-E on the diagram:



b) Name the inflorescence shown in a)

c) State how the inflorescence shown in a) encourages effective pollination by butterflies

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Q2 a) Even though the question clearly indicates that the diagram shows an inflorescence, some candidates referred to it as 'a flower' and so incorrectly labelled the features, labelling A as carpels B as petal, C as sepal, D as a pedicel.

However, most candidates correctly named:
A and B as disc florets and ray florets respectively for full marks although some called these 'flowers' instead of 'florets' and labelled B as 'petal' and these answers were credited with half a mark.

C although the arrow points to a single bract, the name for a collection of bracts called an involucre was also accepted. Some candidates misidentified this as a sepal or 'calyx'. Sepals are located in each individual floret.

D is a peduncle, the stem supporting the whole inflorescence, not to be confused with a pedicel which supports an individual flower. Many candidates incorrectly labelled this as the pedicel.

E is the fused receptacle to which the florets are attached, many candidates could not name this.

b) Most candidates were able to identify the inflorescence as a capitulum although there were a variety of incorrect spellings. 'Composite inflorescence' was also credited.

c) Candidates were asked to state how the capitulum inflorescence encourages effective pollination by butterflies. Some did not relate their answer to this group of pollinators specifically.

Candidates were required to give a *feature* of the capitulum and then an *explanation* of how this encourages effective pollination by butterflies. Many failed to give the second part of the answer so lost marks here. Four features fully described gained full marks. Popular examples included:
A suitable colour e.g., yellow, purple, and pink which are attractive to butterflies**;** 'brightly colored' **is** not as specific and so did not receive full marks.
Disc florets closely packed close together or providing a 'landing platform' to reduce the distance travelled by butterflies feeding or reduce the energy required as they can visit many flowers on the same structure at the same time.
Nectaries positioned at the base of the corolla tube which can be reached by the long proboscis/tongue of the butterfly
A narrow tubular corolla which matches the length of the butterfly tongue.
The large number of florets packed together increases visibility from a distance (butterflies target flowers visually) -some likened the pattern created by the sequentially ripening anthers to a 'bullseye', luring the butterfly in towards the landing pad.
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Q3 **a)** State what is meant by the term 'transpiration'

b) Explain how **THREE** distinct structural features of a leaf of *Pinus sylvestris* reduce transpirational water loss

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Q3 a) Surprisingly few candidates were able to correctly define 'transpiration' very simply as the loss of water vapour from leaves. Many did not make it clear that water escapes from the stomata as a VAPOUR in the transpiration process. Many candidates wrongly described the passage of water through the plant from the root to the leaves or the transpiration STREAM, rather than the process itself and therefore could not be awarded the mark.

b) Better candidates gave a full explanation of how the chosen feature of a *Pinus sylvestris* leaf reduces transpirational water loss (not just that it 'slows water loss') as three marks were awarded for each feature.

- The structural feature of sunken stomata was a popular choice and most candidates stated correctly that this increases the humidity close to the stoma or widens the boundary layer. A full answer went on to explain that this leads to a reduced water vapour gradient from inside to outside the leaf so slows the rate of water loss.
  Candidates from some centres were under the impression that stomata are positioned only 'on the underside of the needle' which is not the case for *Pinus sylvestris* where stomata occur on both the abaxial and adaxial surfaces.

- Many candidates mentioned the cuticle but this is present in most leaves so it was necessary to say that this is a *thickened* cuticle. This is a waterproofing, waxy layer containing cutin (not suberin or lignin) which prevents water loss from the underlying epidermis. Description of a 'thick waxy <u>layer</u> on the leaf surface' could only be partially credited.

- Needles reduce the surface area of leaf so there is less exposure to heat and wind so there are fewer stomata and a smaller surface to absorb heat. Needles do not curl or roll when water stressed and their edges do not curl inwards to hold water on their surface.

Most candidates identified two distinct structural features but some were not able to identify three.
Other structural features such as the endodermis or the lack of a spongy mesophyll were rarely mentioned.
Resin production is thought to deter herbivores, and has protectant and anti-microbial properties rather than reduce water loss.
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Q4 **a)** Describe the development of a true fruit following fertilisation

b) State ONE NAMED plant example and TWO structural characteristics for EACH of the dry fruit categories below:

i) nut
ii) follicle

by completing the table below.

Dry fruit	**NAMED plant example**	**Characteristic**
Nut		
Follicle		

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Q4 a) Few candidates were able to describe fully the development of a true fruit following fertilisation. Many gave the process of fertilisation after pollination which was not asked for rather than fruit development.

Most candidates could state that the fruit develops from the ovary and other flower parts wither and disappear but there was some confusion about naming the layers of the fruit or pericarp. The pericarp refers to all three layers together and the term was often incorrectly attributed. The three layers are:

- endocarp which develops from the inner surface of the ovary,
- exocarp or epicarp from the outer surface of the ovary
- with the mesocarp in between.

Many correctly stated that the mesocarp can be fleshy but it can also be dry.
The ovule with its surrounding integuments becomes the seed and the fertilised ovum the embryo within the seed.
Marks could also be awarded for mentioning that the plant growth regulator auxin triggers fruit development and ethylene promotes ripening. However few candidates referred to the role of endogenous plant growth regulators in the fruit development process.

b) i) Most candidates could give an example of a nut, commonly *Quercus robur* or *Castanea sativa*. (Unfortunately, *Juglans regia* (walnut) produces drupes NOT nuts). Detailed descriptions were not required here so simply stating any two points from nuts are indehiscent, have a stony or woody pericarp, one carpel and a single seed was sufficient to score full marks.

ii) For follicle, popular examples were *Magnolia grandiflora* and *Aquilegia vulgaris*. Some candidates confused follicle with a capsule. A follicle is dehiscent, splitting along one side with 1 carpel and two or more seeds.
Many confused the terms ‘dehiscent’ (which is when a fruit splits open as it dries to dispel its seed) which occurs in the case of a follicle, with indehiscent, which is when the fruit does NOT split as it dries (and is therefore shed with the seed) as in the case of a nut.
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Q5 **a)** Describe the formation of the periderm (outer bark) in a woody stem

b) Describe the characteristics of cells in **THREE** of the tissue layers of the periderm

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Q5 a) This part of the question was not generally well answered. Many candidates were not familiar with the term 'periderm' and instead described the process of secondary thickening involving production of secondary xylem and phloem by the vascular cambium. Equally the alternative term for the periderm 'outer bark' was misinterpreted as just the outermost corky layer (phellem). Few were clear that the periderm/outer bark is comprised of the phellogen (cork cambium) and the products of the division of this tissue.

The periderm is formed to replace the epidermis as the girth of the woody stem expands. Three new tissues are formed in the cortex: the phellogen (cork cambium) which produces phellem (cork layer) to the outside and phelloderm (secondary cortex to the inside). Stomata are replaced by lenticels. Some candidates were able to name the 3 layers but were unable to describe how they were formed or confused the tissue as a whole (periderm) with its 3 layers.

Candidates who did not name the tissues in their response to part a) but did so in part b) were credited.

b) This part was poorly answered and many described the layers rather than the characteristics of the cells which comprised them. Candidates needed to know the *type* of cells which make up these tissues. It was apparent that some misinterpreted the question- the question asks for a description of the CELLS -some described the function of the tissues, some duplicating information given in part a).

Phellem /cork: cork cells in the phellem are tightly packed, have suberin in the thickened cell wall and no cell contents.

Phellogen: cells are meristematic have many mitochondria, no vacuole, cuboid, tightly packed and undifferentiated.

Phelloderm: cells have thin cellulose cell walls, cell contents, include a nucleus, mitochondria, cytoplasm and a large vacuole and may store starch.

Candidates who did not know the three tissues of the periderm/outer bark commonly described phloem and xylem tissue in c); some described sclereids (sclerenchyma tissue) that can form in the *inner* bark/secondary phloem of some species, but this could not be credited.
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Q6 Land plants are thought to have evolved from aquatic algae.

Explain how **FIVE** distinct characteristics of angiosperm **stems** have enabled them to live on land.

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Q6 This was a challenging question and was poorly answered by some candidates. Detailed descriptions of five features were needed for full marks focussing on the problem of water uptake and loss in plants growing on dry land. Some candidates described plant organs other than stems, i.e., roots or leaves so could not be rewarded.

The presence of a vascular system was the most popular feature. This enables water, minerals, nutrients etc. to be transported from the leaves and roots to other parts of the plant where they are needed. It also enables plants to grow upwards providing support allowing them to compete for light for photosynthesis.

Secondary thickening in woody stems or turgor and supporting tissues such as sclerenchyma and collenchyma in herbaceous stems also strengthen the stem and enable the plant to grow higher, and in woody stems allows increased water uptake.

A waterproof cuticle on herbaceous stems or bark on woody stems prevents/reduces water loss and protects from herbivores, other pests and diseases.

Thorns as a stem adaptation for protection and prickles for protection as well as climbing in some cases, were credited.

Stomata in the epidermis of herbaceous stems can regulate water loss but still enable gas exchange for respiration and photosynthesis.

Stems adaptations such as stem tubers as perennating organs to survive winter or unfavourable conditions and stem tendrils or twining habit to increase height for greater light capture and photosynthesis, were also valid responses.

If a characteristic was stated with no explanation of its benefit, then full marks were not credited.
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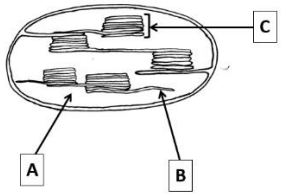
Q7 **a)** Name the structures labelled A-C on the diagram below:



Structure of a chloroplast

b) Describe the photosynthetic processes which take place on structures A and B in the diagram in a)

Structure A……..

Structure B…….

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Q7 a) Most candidates correctly identified the features as:

A= stroma
B = thylakoid membrane and
C = grana.

Some candidates mistook the mitochondrion for a cell and wrongly named cell features instead. The spelling of thylakoid presented problems for some. Some candidates knew the names but transposed them, labelling the stroma as thylakoid or grana and vice versa.

b) This part of the question was well answered with most candidates effectively describing the photosynthetic processes in some depth.

Structure A (stroma) is the site of the light independent reactions (‘dark reactions’ or Calvin Cycle). The fixation of carbon dioxide is catalysed by the enzyme RuBisCO to produce glucose with the use of hydrogen from NADPH and electrons and ATP, all generated by the light dependent reactions.

Structure B (thylakoid membrane) is the site of the light dependent reactions (‘’light reactions), where light is absorbed by/excites electrons in chlorophyll and its energy is used to split water with the release of oxygen. The hydrogen is trapped by the carrier NADP to produce NADPH. Electrons are released which pass along an electron transport chain culminating in the production of ATP.
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Q8 *Malus* cultivars (apple) are generally obligate cross-pollinated plants.

i) State **TWO** benefits of cross pollination to the plant.

ii) Describe **FOUR** methods growers use to optimise pollination in apple orchards.

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Q8 i) Most candidates were able to state that cross pollination leads to greater genetic diversity which means that they can survive environmental pressures and have improved pest and disease resistance. Some also mentioned hybrid vigour being introduced leading to greater yields. Only two marks were allocated here so long descriptions were not required.

ii) This question was answered well.
Most candidates were able to describe four methods to optimise pollination in an apple orchard. Better candidates described the method in more detail for higher marks. Most knew that a range of apples cultivars need to be grown close to each other and that the trees must flower at the same time. These are known as 'pollination groups' and many candidates gave detailed descriptions of the need for cultivars to be from the same or adjacent groups.

Some candidates confused genetic compatibility with flowering groups/time.

The need for genetically compatible cultivars was rarely mentioned although many correctly described the need for two compatible cvs. to effectively pollinate triploid trees as well as each other and gave named examples.

Many were aware that *Malus sylvestris* (crab apples) can also be planted in the orchard to act as a 'universal pollinator' with a long flowering period and this was credited where related to either compatibility or flowering period but not both.

Other popular answers were to introduce bee hives into the orchard as bees are the main pollinator, creating additional habitat for pollinators such as growing wildflowers to attract bees or conversely an argument can be made for the removal of wildflowers to reduce competition with the fruit blossom. Windbreaks to prevent damage to flowers and protect pollinators and the reduction and controlled application of pesticides were also mentioned along with grafting of 'family trees'.
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Q9 **a)** Define what is meant by the following terms, giving a **NAMED** plant example for **EACH,** by completing the table below:

Term	**Definition**	**Plant example**
Short day plant		
Long day plant		
Day neutral plant		

b) State how gibberellin affects flowering when applied to plants.

c) State what is meant by the term 'florigen'

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A range of responses were given to this question but it was poorly answered by many candidates.

Q9 a) Few candidates could correctly define the photoperiodic terms; simply stating that flowers are produced in 'long' or 'short' days or that plants require a 'long' or 'short' dark period or mentioning particular daylengths such as 8 or 12 hours, was insufficient. The answer had to refer to the critical daylength. Short day plants flower when the daylength is less than the plant's critical daylength whilst long day plants flower when the daylength is more than their critical daylength. Most candidates could state that day neutral plants are unaffected by daylength.

Candidates should be encouraged to give well known plant examples which can be verified such as:

Short Day Plant (SDP) *Chrysanthemum morifolium, Euphorbia pulcherrima, Kalanchoe blossfeldiana*

Long Day Plant (LDP) *Spinacia oleracea, Raphanus sativus, Petunia x hybrida*

Day Neutral Plant (DNP) *Solanum lycopersicum, Cardamine hirsuta, Zea mays, Taraxacum officinale.*

Fragaria spp. are not a good choice as some are SDP some are LDP and some are DNP; equally *Helianthus annuus* cultivars vary, most are DNP but some are facultative LDP and SDP.

b) Most candidates stated that gibberellin stimulates flowering; however, as there are three marks available, more detail was required.
Gibberellin can overcome the need for vernalisation (a cold treatment) to trigger flowering in some plants especially rosette forming biennials. It was well known that gibberellin stimulates internode elongation, triggering bolting. Gibberellin also lengthens flower stems in *Gerbera*, promotes larger flowers in *Gardenia* and flowering in azalea and *Chrysanthemum* pot plants.

c) Few candidates knew that 'florigen' is a name given to a yet to be identified chemical or protein that acts as a plant growth regulator-moving from the leaves to the meristem where it triggers flowering.
Many candidates confused it with phytochrome.
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Q10 **a)** Describe the transport of sucrose from a leaf to a root under the following headings:

i) phloem loading
ii) passage in the phloem
iii) phloem unloading

b) Explain how **TWO** features of sieve tube cells optimise sucrose transport

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Q10 a) Candidates who scored highly could give the detail of sucrose transport required but many answers were not precise enough. Many did not read the question which clearly states that it is sucrose that moves, not glucose or starch, whilst others described sugars moving to stem tubers etc. but the question states that a description of movement between a leaf and a root is required.

i) Phloem loading
Most were aware of the terms source (in this case the leaf) and sink (the root)
However, very few candidates described how the sucrose moves from the leaf mesophyll into the phloem sieve tube elements via companion cells, phloem parenchyma or 'transfer cells', and that this an active process which requires ATP/energy as the sugar is moving against a concentration gradient (there is a higher concentration of sucrose in the phloem).

ii) Passage in the phloem
Passage in the phloem was not well described with some incorrectly stating that sugar moves by osmosis. The high concentration of sucrose in the sieve tube cells draws in water from the xylem by osmosis. Water entering the sieve tube cells sets up a hydrostatic pressure at the source and sucrose is transported under this pressure through the phloem by mass flow towards the sink (where the pressure in the phloem is less due to the removal of sugar and then water) and is known as the 'Pressure- Flow Hypothesis'

iii) Phloem unloading
At the root (the sink), sucrose is removed and this may be an active or a passive process. The water is returned to the xylem, thereby reducing the hydrostatic pressure in the phloem. This maintains the pressure difference between source and sink. At the root the sucrose is used for respiration, used by the meristems for growth or converted into starch for storage.

Candidates should note that osmosis is *only ever* the movement of water.

b) Few candidates could describe two features of sieve tube cells.

Most candidates earned marks for stating that the cells are joined end to end to form a sieve tube through which the sucrose can flow between source and sink.
Some candidates also knew that they contain cytoplasm with mitochondria to generate ATP for active transport of sucrose but have no nucleus which would otherwise obstruct the flow of sucrose.
Sieve plates were poorly described. These are pores in the end walls of sieve tubes which enable the cytoplasm of adjacent cells to connect via plasmodesmata so the sucrose does not have to cross a membrane enabling easier transport.

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