



R2114

**UNDERSTANDING PROTECTED ENVIRONMENTS &
THEIR USE IN PLANT CULTIVATION**

Level 2

Tuesday 7 February 2023

15:20 – 16:10

Written Examination

Candidate Number:

Candidate Name:

Centre Name:

IMPORTANT – Please read carefully before commencing:

- i) The duration of this paper is **50** minutes;
- ii) **ALL** questions should be attempted;
- iii) **EACH** question carries **10 marks**;
- iv) Write your answers legibly in the spaces provided. It is **NOT** necessary that all lined space is used in answering the questions;
- v) Use **METRIC** measurements only;
- vi) Use black or blue ink only. Pencil can be used for drawing purposes only. Ensure that all diagrams are labelled accurately with the line touching the named object;
- vii) Where plant names are required, they should include genus, species and where appropriate, cultivar;
- viii) Where a question requires a specific number of answers; only the first answers given that meet the question requirement will be accepted, regardless of the number of answers offered;
- ix) Please note, when the word '**distinct**' is used within a question, it means that the items have different characteristics or features.

ANSWER ALL QUESTIONS

Q1 Describe **ONE** distinct horticultural use for **EACH** of the following protected structures:

- i) greenhouse
- ii) cold frame
- iii) polythene tunnel
- iv) cloche
- v) conservatory

MARKS

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Total Mark

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MARKS

Q2 Describe **TWO** effects on plant growth for **EACH** of the environmental factors listed, by completing the table below.

Environmental Factor	Effects on plant growth
Low natural light levels	1.
	2.
High relative humidity	1.
	2.
Erratic irrigation	1.
	2.
Poor air movement	1.
	2.
Excessive watering	1.
	2.

2

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Total Mark

Please turn over/.....

Q3 For the framework of a protected structure

- i) Name **FOUR** materials commonly used in its construction
- ii) State **TWO** limitations for **EACH** construction material

by completing the table below;

Name of Material		Limitation 1	Limitation 2
1.			
2.			
3.			
4.			

2.5

2.5

2.5

2.5

Total Mark

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MARKS

Q5 a) Describe **EACH** of the following methods of irrigation:

- i) drip irrigation
- ii) overhead spray irrigation

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b) Describe **TWO** limitations of **EACH** of the methods named in a).

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Total Mark

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**The Royal Horticultural Society, Wisley, Woking, Surrey GU23 6QB.
Charity Registration Number: 222879/SC038262**

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THEIR USE IN PLANT CULTIVATION**

Level 2

Tuesday 7 February 2023

Candidates Registered		Total Candidates Passed	
Candidates Entered	421	Passed with Commendation	133
Candidates Absent/Withdrawn	TBA	Passed	227
Candidates Deferred	TBA	Failed	61

Senior Examiner's Comments:

- 1 Candidates should be able to demonstrate a good range of plant knowledge and be able to give accurately named plant examples where appropriate. Common names and generic names are often too vague and cannot be rewarded in the positive manner that genus, species and where appropriate, variety/cultivar can. This is particularly important when answering questions relating to particular (named) plant(s). Marks can only be awarded for these narratives where the example(s) are correctly and fully identified.
- 2 Candidates must be able to display accurate knowledge of the technical terms and concepts detailed in the syllabus, in the context of horticulture and also be aware that wider interpretation will not be rewarded. The examination should be regarded as a possible introduction to higher level studies, which will only be open to those who are in possession of a clear understanding of the horticultural terms and concepts which are current.
- 3 The introductory rubric given on the first page of each question paper should be read carefully by candidates. At each examination there are a significant number of candidates who ignore or misread the instructions given and consequently may not perform as well as they could have done.
- 4 Candidates should pace themselves during each paper. The most successful candidates allow sufficient time to read the question thoroughly before answering it and also take time to read through their answers. They should take care to write as legibly as possible, so that the examiner is in no doubt about what is intended.
- 5 Candidates need to interpret key words within questions, particularly those such as 'state', 'list' and 'describe'. Questions requiring descriptions or explanations obviously require a more detailed answer than those requiring a list.

- 6** It is important to ensure that responses to questions are to the point. Candidates should bear in mind that small sketches might be used to convey information more succinctly than words.

- 7** Successful candidates ensure that their answers are focused and to the point. It is disappointing when they cannot be rewarded for their efforts because the answer is irrelevant to the particular question. Candidates should take note of the mark allocation for specific sections and allocate their time and efforts accordingly.

- 8** Diagrams can enhance an answer and where appropriate can replace detailed descriptions. They should be large, clear and well annotated, ensuring that labels are properly attached to the features they describe. Diagrams should preferably be in pencil. Colour may be used successfully but only where it is relevant to the answer.

- 9** In each examination it is clear that some candidates are ill prepared to answer papers of the type set. It is essential that candidates have the opportunity to practice questions. Ideally some papers should be answered in a time constrained situation. Appropriate feedback must, in any case be provided

Q1

Describe **ONE** distinct horticultural use for **EACH** of the following protected structures:

- i) greenhouse
- ii) cold frame
- iii) polythene tunnel
- iv) cloche
- v) conservatory

Q1a) Candidates who had a clear understanding of the horticultural uses of specific protected structures gained maximum marks. Suitable answers included:

i) **Greenhouse**

A greenhouse is a structure which can be heated and is therefore suitable for extended cropping periods. It is suitable for growing main season crops e.g. tomatoes, lettuce, peppers as well as all year round cut flower crops e.g. chrysanthemum.

ii) **Cold frame**

A cold frame can be used to cover low row crops e.g. lettuce or strawberries or used to advance the establishment of tall crops such as beans by pre-warming the soil and then removing the structure before they reach the top. A cold frame can be used to provide frost protection for some crops, propagation and hardening off plants e.g. half-hardy annuals.

iii) **Polythene tunnel**

A polythene tunnel is suitable for crops that require higher relative humidity e.g. self-blanching celery. Other crops e.g. salads can be grown in a polythene tunnel although it is less economic to heat as heat is lost through the polythene sheet cladding.

iv) **Cloche**

Cloches can be used to protect individual plants e.g. lettuce from frost or placed in a row to protect row crops e.g. lettuce and strawberries. Cloches can also be placed over soil prior to sowing to warm the soil.

v) **Conservatory**

A conservatory is usually attached to a house and is used to display feature plants. It can also be used to germinate seedlings and harden off plants as the conservatory is normally heated from the house central heating system.

Q2

Describe **TWO** effects on plant growth for **EACH** of the environmental factors listed, by completing the table below.

Environmental Factor	Effects on plant growth
Low natural light levels	1. 2.
High Relative humidity	1. 2.
Erratic Irrigation	1. 2.
Poor air movement	1. 2.
Excessive watering	1. 2.

Q2) Full marks were awarded to candidates who were able to provide good descriptions of the effects on plant growth of specific environmental factors. These included:

Environmental Factor	Effects on plant growth
Low natural light levels	1. Etiolated growth, weaker growth, reduced plant vigour.
	2. Growth more susceptible to pests and diseases.
High relative humidity	1. Less transpiration, therefore slower nutrient uptake.
	2. Greater chance of fungal diseases. Oedema may occur due to excess water in the leaves.
Erratic irrigation	1. Splitting of tomato fruits and chlorosis observed around the edge of the foliage of plants.
	2. Temporary wilting in plants. Root death which will result in plants wilting.
Poor air movement	1. Reduced growth due to low carbon dioxide concentrations.
	2. Pockets of high relative humidity resulting in fungal diseases.
Excessive watering	1. Plants will wilt due to anaerobic conditions which will result in root damage and death.

Q3

For the framework of a protected structure

- i) Name **FOUR** materials commonly used in its construction
- ii) State **TWO** limitations for **EACH** construction material

by completing the table below;

Name of Material	Limitation 1	Limitation 2
1		
2		
3		
4		

Q3) A range of construction materials for a protected structure, and their limitations were provided by the best candidates who achieved maximum marks. Acceptable answers included:

Name of Material	Limitation 1	Limitation 2
1. Steel	Very heavy.	Will rust if not galvanised.
2. Wood	Will rot if not painted, or treated with a preservative.	Weaker material than metal. Requires thicker beams, struts which reduces the entry of natural light.
3. Aluminium	Not strong enough for large glasshouses.	It is very expensive compared to softwood and plastic.
4. Plastic	Not very strong for large structures. Tensile and load bearing strength is poor.	Can become brittle when exposed to sunlight for long periods. Cannot fix wire to structure.

Candidates who named cladding materials could not be awarded any marks.

Q4

Describe the production of the cut flower crop *Chrysanthemum x morifolium* under EACH of the following headings.

- i) propagation and establishment
- ii) crop maintenance

Q4) The majority of candidates were able to describe specific aspects of the production of *Chrysanthemum x morifolium* and gained full marks. Suitable answers included:

i) **Propagation and establishment**

Chrysanthemum x morifolium are propagated by stem tip cuttings which are up to 100mm in length, cutting below a node with a sharp knife. The lower third of leaves are removed and the cutting is treated with hormone rooting powder before being inserted into trays or pots with a rooting media that is well drained but moisture retentive. The cuttings, which are kept moist are rooted on a mist bench or closed case with a basal temperature of 21-23°C.

Once rooted the cuttings are planted out into beds where the soil has been partially sterilised to kill any weed seedlings or soil borne pests and diseases. A base fertiliser can be applied to the soil if required. The rooted plants are spaced 20cm apart and watered overhead until they are established.

ii) **Crop maintenance**

Once the plants have produced some growth, they are stopped by pinching out the tip to encourage several stems to be produced. The stems are supported by netting which is raised as they grow. The plants will require feeding on a regular basis which can be provided as a liquid feed at the same time as irrigation.

Once the stems produce flower buds they will need to be disbudded if being grown as blooms. The lateral buds are removed, leaving the terminal bud which will develop into a large bloom which is sold as a cut flower.

The plants also need to be monitored for pests and diseases and controls put in place if required. These could include;

Pests - two spotted mite, capsid bug, earwig, aphid.

Diseases – powdery mildew, botrytis/grey mould.

Q5

a) Describe **EACH** of the following methods of irrigation:

- i) drip irrigation
- ii) overhead spray irrigation

b) State TWO limitations for EACH of the irrigation methods in a).

Q5a) Many candidates had a good knowledge of specific methods of irrigation and were awarded maximum marks. Acceptable answers included:

i) **Drip irrigation**

Drip irrigation is supplied to a bench or line of containers via a network of polythene pipes which are connected to a main water source. Narrow capillary tubes connected to these pipes are anchored, normally by the use of a plastic peg, which is inserted near the main stem of the plant. Water is delivered as a continuous drip to the root zone from these tubes. The system is usually automatically controlled.

ii) **Overhead spray irrigation**

Water is supplied as an overhead spray from nozzles, which are attached at regular intervals to pipes suspended above the crop. Regularly positioned supports ensure that the irrigation line is level and at the correct height above the crop to ensure that there is a good distribution of water.

Q5b) Candidates who were able to provide good descriptions of the limitations of specific irrigation methods achieved full marks. These included:

Drip irrigation

- labour intensive to set up the system
- all of the plants receive the same amount of water
- the capillary tubes can become blocked in hard water areas.

Overhead spray irrigation

- nozzles can become blocked in hard water areas. This may produce a different water distribution pattern
- it is not possible to water the plant without wetting the foliage which can cause problems with fungal diseases
- the water distribution pattern can create gaps or overlaps which is detrimental to the plants i.e. too much or too little water.

Q6

- a) State **THREE** factors to consider when selecting containers for houseplants
- b) Describe **THREE** maintenance tasks for **ONE NAMED** houseplant grown for floral display

Q6a) The best candidates provided a range of suitable factors to consider when selecting containers for houseplants and gained full marks. These included:

- size of the container in relation to its final position
- the shape of the container with regards to its surroundings
- the manufacturing material of the container i.e. it must not leak
- the weight of the container if it needs to be moved on a regular basis
- shape and growing habit of the plant that is going to be placed in the container.

Q6b) Candidates who were able to describe appropriate maintenance tasks for a named houseplant grown for floral display were awarded maximum marks. Suitable answers included:

e.g. *Streptocarpus ionanthus*

Trimming

Dead flowers or foliage are removed by pinching off the shoot at the base and dust can be removed from the hairy leaves with the use of a small paint brush.

Potting on

Select a pot at least one size larger and pot on using John Innes No. 2 growing media. Tease out the root ball of the plant and place it in the middle of the pot and backfill with compost, ensuring that the final level is the same as it was in the previous pot. Firm to ensure any large air pockets have been removed.

Watering

Streptocarpus ionanthus should be watered from below, sparingly as required. The need for watering can be checked by pushing a small cane into the pot to see if it has any damp growing media on it. Water must not get onto the hairy leaves or they will rot. Allow the plant to become fairly dry between watering.

Feeding

Nutrients can be applied in the form of a top dressing, base dress in the growing media or liquid feed either as a controlled release or fast acting fertiliser. The time of feeding will be dependent on the nutrients required by the plant. Nutrients for growth will be applied during the growing season and nutrients to enhance flowering will be applied as flower buds are forming.

Candidates who described the need to inspect the plant on a regular basis to identify and control any specific pests and diseases by named methods were also awarded full marks.