



R2114

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

Level 2

Tuesday 20 June 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 a) Describe **THREE** distinct horticultural uses for a greenhouse.

MARKS
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b) Describe **TWO** different types of cloche used in protective cropping.

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MARKS

Q3 a) State the difference between cladding and framework for a protected structure.

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b) Describe **TWO** named cladding materials suitable for a cold frame.

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c) Describe **ONE** horticultural use of shade netting for a named protective structure.

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MARKS

Q4 a) Describe **ONE** method of controlling the environment in a glasshouse for **EACH** of the following:

- i) heating
- ii) ventilation.

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b) Describe how a glasshouse structure can be cooled without the use of ventilation.

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MARKS

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Q5 a) Describe biological and cultural methods of control in protected structures by completing the table below:

	Biological control	Cultural control
Definition		
Example		
Named horticultural situation		

b) State **TWO** advantages of biological control over chemical control.

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MARKS

Q6 Describe the management of **ONE** named fern under **EACH** of the following headings:

- i) propagation
- ii) watering
- iii) environmental control.

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Named Fern:.....

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

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UNDERSTANDING PROTECTED ENVIRONMENTS & THEIR USE IN PLANT CULTIVATION

Level 2

Tuesday 20 June 2023

Candidates Registered	489		Total Candidates Passed	360	85%
Candidates Entered	421	86%	Passed with Commendation	133	31%
Candidates Absent/Withdrawn	56	11%	Passed	227	54%
Candidates Deferred	12	3%	Failed	61	15%

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) Describe **THREE** distinct horticultural uses for a greenhouse.

b) Describe **TWO** different types of cloche used in protective cropping.

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**Q1 a)** Candidates who had a clear understanding of the horticultural uses for a greenhouse achieved full marks. Suitable answers included:

- A greenhouse can be heated and is suitable for growing main season crops e.g. tomatoes, lettuce, peppers as well as all year round cut flower crops e.g. chrysanthemum.
- A greenhouse can be used to propagate a wide range of plants e.g. shrubs, houseplants, seasonal bedding and cut flowers either on a mist bench or in a closed case.
- A greenhouse can be used to display feature plants or specimen plant collections e.g. cacti. Plants are often grouped according to their native environment e.g. temperate or tropical plant house.

**b)** The majority of candidates were able to describe different types of cloches used in protective cropping and gained maximum marks. Acceptable answers included:

A barn cloche is used to cover crops to provide frost protection. They are usually placed end to end to cover a row of e.g. lettuce or strawberries.

A bell cloche is used to cover individual plants e.g. lettuce to provide winter protection or to encourage earlier growth.

- Q2 a)** List **FOUR** environmental factors that are different inside a protected structure compared to outside.
- b) Describe **TWO** benefits and **ONE** limitation of growing crops under protection compared to outside.

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- Q2 a)** Full marks were awarded to candidates who were able to provide environmental factors that are different inside a protected structure compared to outside. These included:

Air temperature, relative humidity, air movement, concentration of carbon dioxide, irrigation requirements.

- b)** A range of benefits and limitations of growing crops under protection compared to outside were provided by the best candidates and were awarded full marks. These included:

Benefits

- ability to be able to grow an increased range of crops and cultivars due to the improved growing conditions
- higher yields from crops due to increased healthy vigorous growth. The crops will be able to grow for an extended period of time
- ability to make use of effective biological control methods and avoid the use of pesticides.

Limitations

- increased cost of production of crops
- requirement for accurate environmental control.

- Q3 a)** State the difference between cladding and framework for a protected structure.
- b) Describe **TWO** named cladding materials suitable for a cold frame.
- c) Describe **ONE** horticultural use of shade netting for a named protective structure.

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- Q3 a)** Most candidates were able to state the difference between cladding and framework for a protective structure and achieved maximum marks. Suitable answers included:

Cladding is the material that is held in place by the framework and allows light to enter the protected structure while framework is the material that the frame of the structure is made from.

- b)** Detailed descriptions of cladding materials suitable for a cold frame were provided by many candidates who gained full marks. Acceptable answers included:

**Horticultural glass**

Horticultural glass allows 90% light transmission and does not deteriorate with age or scratch easily. It is heavy and fragile.

**Twin walled polycarbonate**

Twin walled polycarbonate has good insulation properties as it is double skinned with air pockets between the skins. It allows 75% light transmission and does not shatter. Although it scratches it lasts a long time.

- c)** Candidates who were able to provide an appropriate description of a horticultural use for shade netting in a protective structure were awarded maximum marks. These included:
- shade netting can be used to cover a cold frame to protect young plants from excessive light
  - shade netting can be suspended from the structure below the ridge of a greenhouse to shade crops e.g. Cyclamen on greenhouse staging/benches.

**Q4 a)** Describe **ONE** method of controlling the environment in a glasshouse for **EACH** of the following:

- i) heating
- ii) ventilation.

b) Describe how a glasshouse structure can be cooled without the use of ventilation.

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Q4 a) Full marks were achieved by candidates who were able to describe how to control the environment in a glasshouse. Suitable answers included:

i) heating

The environment in a glasshouse can be controlled using electricity for heating via a convector or fan heater. The fan heater can be connected to ducting which dissipates the hot air around the structure, ensuring even distribution. In a small protected structure, the heater can be positioned in a corner which will enable natural convection currents to spread and distribute the heat evenly.

Hot water heating systems can be used to control the environment in a glasshouse. A boiler burning gas or oil heats up the water which is circulated around the glasshouse structure via a series of pipework to achieve even distribution.

Candidates who described systems using steam or gas heating were awarded full marks.

ii) ventilation

Natural ventilation can be achieved by using ventilators in both the ridge and the sides of a glasshouse. Louvres can also be used in the sides of the glasshouse. These ventilators can be automated according to the air temperature within the glasshouse.

An electrically operated fan/s can be used to extract the air from a glasshouse. Fresh air can enter from the other side of the structure through opening side ventilators. This can be automated by the use of a thermostat to control the operation of the fan and side ventilators.

b) Many candidates provided good descriptions of how a glasshouse structure can be cooled without the use of ventilation and gained full marks. Suitable answers included:

- a glasshouse structure can be cooled by the use of shade netting materials being suspended either inside or outside of the structure. This will reduce the build up of heat within the structure.
- damping down the paths and benches with water will have a cooling effect as the water evaporates and will cool the glasshouse structure.

Q5 a) Describe biological and cultural methods of control in protected structures by completing the table below:

	Biological control	Cultural control
Definition		
Example		
Named horticultural situation		

b) State **TWO** advantages of biological control over chemical control.

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**Q5 a)** Candidates who had a good knowledge of specific methods of control for pests and diseases in protected structures were awarded maximum marks. Suitable answers included:

|                                      | <b>Biological control</b>                                                                                        | <b>Cultural control</b>                                                                                                 |
|--------------------------------------|------------------------------------------------------------------------------------------------------------------|-------------------------------------------------------------------------------------------------------------------------|
| <b>Definition</b>                    | Biological control is the application of living predators, parasites or pathogens to control pests and diseases. | Cultural control is the prevention or control of pests and diseases and weeds by management of the growing environment. |
| <b>Example</b>                       | <i>Encarsia Formosa</i> is a parasitic wasp which is used to kill glasshouse whitefly.                           | Crop rotation to avoid certain pests and diseases e.g. club root.                                                       |
| <b>Named horticultural situation</b> | Tomatoes growing in a greenhouse.                                                                                | Brassicas growing on an allotment or in a vegetable garden.                                                             |

b) The best candidates were able to provide a range of advantages of biological control over chemical control and achieved full marks. These included:

- pests and diseases do not become resistant to biological controls
- there are no crop clearance periods when biological controls are used
- no pesticides which are harmful to the environment are used
- biological control is not harmful to the operator.

**Q6** Describe the management of **ONE** named fern under **EACH** of the following headings:

- i) propagation
- ii) watering
- iii) environmental control.

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Q6 Most candidates were able to describe specific aspects of the management of a fern and gained maximum marks. Acceptable answers included:

i) propagation

Adiantum raddianum can be propagated by spores which are sown in spring in a tray or pot prepared with seed sowing compost. This is watered and allowed to drain before the spores are sown thinly on the surface of the compost. The tray is covered with a sheet of glass and placed in a shaded greenhouse at a temperature 18-20°C. After several months prothalli appear and following fertilisation new fern plants start to develop.

Ferns can also be propagated by division of the plant at the beginning of the growing season. The plant can be carefully divided by hand or with the use of two hand forks to gently tease it apart. Each propagule should have adequate roots and fronds to produce a new plant.

ii) watering

Ferns should be watered using rain water to avoid a build of lime in the growing media. Plants can be watered overhead or from the side of the pot or by capillary action from the base. They can be watered using a watering can and fine rose, drip irrigation or by being stood on a capillary bench. Ferns need to be kept moist at all times, especially during the spring and summer when the fern is growing.

iii) environmental control

Ferns need to be kept at a temperature of 15-18°C depending on species and protected from excessive direct sunlight by the use of shading. Ferns also need to be grown in an environment with a high level of humidity which can be achieved by damping down the concrete floor regularly.
