



**R2114**

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

**Level 2**

**Tuesday 19 June 2018**

**14:50 – 15:40**

**Written Examination**

**Candidate Number:** .....

**Candidate Name:** .....

**Centre Number/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 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.













**©These questions are the property of the Royal Horticultural Society.  
They must not be reproduced or sold.**

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





Sharing the best in Gardening

**R2114**

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

**Level 2**

**Tuesday 19 June 2018**

<b>Candidates Registered</b>	<b>891</b>		<b>Total Candidates Passed</b>	<b>671</b>	<b>88%</b>
Candidates Entered	766	86%	Passed with Commendation	242	32%
Candidates Absent/Withdrawn	113	13%	Passed	429	56%
Candidates Deferred	12	1%	Failed	95	12%

**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)** State the differences between the aerial environment inside a cropped protected structure compared with that outside by completing the table below.

	<b>Inside a cropped structure</b>	<b>Outside</b>
<b>Air temperature</b>		
<b>Air movement</b>		

**2**

**2**

**b)** Describe the effect of high and low values of each of the following on plant growth:

**6**

- i) air temperature;
- ii) air movement.

**Q1a)** The differences between the aerial environment inside and outside of a cropped protected structure were stated by the best candidates who gained maximum marks. Suitable answers included:

The air temperature inside a cropped protected structure is generally higher and can be effectively controlled by the use of ventilation and heating. The occurrence of very low temperatures in a structure is less likely although an air temperature below 0°C can happen.

The air temperature outside of a cropped protected structure will vary according to the seasons of the year. It is generally lower than inside a cropped protected structure.

Although there is less air movement within a cropped protected structure as there is no wind it can be controlled by the grower by the use of ventilation. Convection currents take place as the structure warms up naturally on a summer day.

**Q1b)** Candidates who provided good descriptions of high and low values of air temperature and air movement on plant growth were awarded full marks. Acceptable answers included:

- i) **Air Temperature** Higher levels of air temperature usually encourage plant growth. Every plant has a temperature range at which it will be able to produce optimum growth and excessively high air temperatures can also cause a slowing down of vital processes within the plant. Leaf scorch can occur due to a temporary shortage of water in plant leaf cells. Low air temperatures will slow down processes in the plant e.g. photosynthesis and respiration and result in reduced plant growth. Extreme reductions in air temperature can cause plant cells to freeze and subsequent cell collapse and death of the plant.
- ii) **Air Movement** Higher levels will affect the amount of water loss from the foliage of the plant by transpiration which will affect the amount of water and nutrients taken up by the plant. Excessive air movement can cause physical damage to the plant. Lower levels of air movement will reduce the rate of transpiration which can affect the amount of nutrients taken up by the plant and the level of humidity around the plant.

**Q2 a)** State **FOUR** factors that affect the amount of natural light entering a glasshouse structure.

**4**

b) Describe how **TWO** of the factors stated in a) can enable a grower to maximise natural light entry into a glasshouse.

**6**

**Q2a)** Most candidates were able to provide a range of factors that affect the amount of natural light entering a glasshouse structure and gained full marks. The best answers included:

- Orientation of the structure
- Design of the protective structure
- Cleanliness of the cladding material
- Constructional materials

**Q2b)** Good descriptions of the factors that affect natural light entering a glasshouse were given by many candidates who were awarded full marks. These included:

**Orientation of the structure** – The amount of natural light entering the structure is determined by the amount of glass presented to the sun. If the glasshouse is orientated east/west with the longest side facing the sun the amount of light entering the structure will be maximised.

**Design of the Protective Structure** – Most light will pass into a structure where the light strikes the glass at an angle of  $90^\circ$  (known as the angle of incidence). By designing a Mansard shaped structure or by raising the eaves as high as possible natural light entry into a glasshouse will be maximised.

**Q3 a)** Describe **TWO** distinct ways of shading crops growing in a protected structure.

**4**

**b)** Explain what is meant by the terms 'supplementary lighting' and give **ONE** example of its use.

**6**

**Q3a)** To gain maximum marks candidates were required to describe ways of shading crops growing in a protected structure. Suitable answers included:

**Shade Paint** can be applied to the outside of a glasshouse structure during early spring as the sun becomes stronger. It is plastic based and sprayed on using a knapsack sprayer or painted on using a brush.

**Shade Netting** e.g. Rokolene can be suspended across the base of the eaves of the structure in early spring to avoid leaf scorch on plants. This can easily be removed in the autumn when light levels are reduced.

**Q3b)** The majority of candidates were able to explain what is meant by supplementary lighting and gained full marks. Acceptable answers included:

Supplementary lighting is artificial lighting which is used to supplement natural light. This provides an extension to the growing day during the winter months when the day length is shortened as well as additional lighting during the hours of daylight when there is insufficient light to achieve optimum growth.

An early main season tomato crop may require supplementary lighting between potting and planting early in the season when natural light is poor.

**Q4 a)** State **TWO** distinct characteristics of materials used in the manufacture of containers used in protected environments by completing the table below:

	<b>Characteristic 1</b>	<b>Characteristic 2</b>
<b>Polystyrene</b>		
<b>Plastic</b>		
<b>Peat</b>		

**2**

**2**

**2**

**b)** State **ONE** benefit **AND ONE** limitation of **ONE** of the materials named in a).

**2**

**c)** Name **TWO** materials commonly used in the manufacture of containers for displaying interior plants (excluding plastic).

**2**

**Q4a)** Most candidates were able to provide a range of characteristics for the materials and were awarded full marks. Suitable answers included:

**Polystyrene** is very light in weight and is a good insulator of heat and cold.

**Plastic** is impermeable to water and becomes brittle when exposed to light.

**Peat** is very difficult to re-wet once it has dried out and is usually acidic.

**Q4b)** Full marks were gained by the majority of candidates who provided a range of benefits and limitations of the materials. Acceptable answers included:

**Polystyrene**

**Benefit** – Easy to transport as very light.

**Limitation** – Difficult to dispose of as non-recyclable.

**Plastic**

**Benefit** – Waterproof and lightweight.

**Limitation** – Becomes brittle with age when exposed to light.

**Peat**

**Benefit** – natural material which can be re-used.

**Limitation** – Although a re-newable material it takes a very long time. Also very difficult to re-wet once it becomes dry.

**Q5 a)** Describe the production of a crop of *Cyclamen persicum* under the following headings:

- |     |                                       |          |
|-----|---------------------------------------|----------|
| i)  | <i>propagation and establishment;</i> | <b>4</b> |
| ii) | <i>plant husbandry.</i>               | <b>3</b> |

b) Describe the damage caused by **ONE NAMED** pest that affects *Cyclamen persicum*. **3**

**Q5a)** Many candidates described the specific aspects of the production of a crop of *Cyclamen persicum* and were awarded full marks. Suitable answers included:

- i) **Propagation and Establishment** – Cyclamen is a large seed which has a hard seed coat which can be softened by soaking for 12 hours prior to sowing. Seeds can be sown in individual modules or seed trays using a peat-based sowing media e.g. John Innes seed compost. The seeds are germinated at a temperature of 21 - 24°C and should be kept moist but not wet.

Once germinated a corm will begin to form. The plants should be potted on using John Innes No.1 compost taking care not to bury the corm.

- ii) **Plant Husbandry** – The plants can be grown on at a temperature of 15 - 18°C ensuring that they are well ventilated and kept moist by the use of capillary irrigation. Plants should be spaced so that the foliage is not touching and they can be fed with a balanced John Innes liquid feed as required with a higher level of potassium at the flowering stage. Plants can be potted into a 14cm half pot using John Innes No. 3 compost as required.

**Q5c)** Candidates described the damage caused by a range of pests that affect *Cyclamen persicum* and gained full marks. These included:

**Vine Weevil** The rounded larvae of vine weevil which have a brown head eat the roots of *Cyclamen persicum*. In severe infestations all roots are eaten and the plant collapses. The plant will also wilt in warm conditions due to the lack of roots.

**Sciarid Fly**

The larvae of the sciarid fly are small, long and almost transparent. They tunnel within the root system of *Cyclamen persicum* and eat the roots until they are shredded. The adult flies can be seen on the surface of the growing media.

Descriptions of the damage caused by; Red Spider Mite and Cyclamen Mite were also accepted.

**MARKS**

**Q6 a)** Name **FOUR** ingredients commonly used in house plant growing media.

**4**

**b)** State **THREE** main characteristics of growing media used for growing house plants and explain why they are so important.

**6**

**Q6a)** Most candidates named suitable ingredients used in house plant growing media and were awarded full marks. These included:

- Horticultural grit or sharp sand
- Peat
- Loam
- Bark
- Controlled release fertilisers
- Coir

**Q6b)** Full marks were achieved by candidates who were able to explain the importance of the main characteristics of growing media used for growing house plants. Acceptable answers included:

- A growing media must have a good water retention capacity to maintain the turgidity of cells. Without water nutrients cannot be taken up into the plant via the root system which are essential for plant growth.
- A good air to water balance must be maintained within the growing media to enable the plant to respire. Oxygen is essential for aerobic respiration to take place within the plant.
- Growing media must have the ability to retain nutrients which are available to the plant for growth.