



Candidate Number:

Candidate Name:

Centre Number/Name:

**RHS LEVEL 3 ADVANCED CERTIFICATE IN HORTICULTURE
WRITTEN EXAMINATION**

Tuesday 4th July 2006

IMPORTANT – Please read carefully before commencing.

- i) The duration of the papers in Module **A** is **2 hours**.
- ii) Answer **ALL** questions in Section **A**.
- iii) **ALL** questions in Section **A** carry equal marks.
- iv) Write your answers legibly in the spaces provided.
- v) Use **EITHER** metric **OR** imperial measurements, but **NOT** both.
- vi) Where plant names are required, they should include genus, species and where appropriate, cultivar.

Module A

Plant Propagation, Growing Media & Plant Nutrition

Section A – Short Answer Questions

Please turn over/.....

ANSWER ALL QUESTIONS

Marks

Q1 Name **TWO** plant seeds that require light to germinate and **TWO** plant seeds that require darkness to germinate.

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Q2 Explain the difference between the terms 'scarification' and 'stratification' in relation to plant seeds.

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Q3 **NAME FOUR** essential components of a mist unit, stating the function of **EACH**.

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Please see over/.....

ANSWER ALL QUESTIONS

Marks

Q4 State the use of **EACH** of the following types of graft providing an appropriate **NAMED** plant example in **EACH** case:

- i) side-veneer graft;
- ii) whip-and-tongue graft.

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Q5 Explain the difference between the soil air and water relationships in a sandy soil as compared with a clay soil.

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Q6 Explain **FOUR** methods by which nutrients can be permanently, or temporarily, lost from soil, or growing media.

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Please turn over/.....

ANSWER ALL QUESTIONS

Marks

Q7 State with reasons **TWO** positive and **TWO** negative effects of cultivation in soil structure.

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Q8 Explain the role of nitrogen in the metabolism of a plant.

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Q9 Define the term 'Law of Limiting Factors' in relation to growth development.

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Please see over/.....

ANSWER ALL QUESTIONS

Marks

Q10 Define the technique 'Aeroponics' and state how it may be used to propagate plants.

2

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WRITTEN EXAMINATION**

Tuesday 4th July 2006

IMPORTANT – Please read carefully before commencing.

- i) The duration of the papers in Module **A** is **2 hours**.
- ii) Answer **ONE** question from Section **B** and **TWO** questions from Section **C**.
- iii) **ALL** questions carry equal marks.
- iv) Write your answers legibly in the answer booklets provided.
- v) Use **EITHER** metric **OR** imperial measurements, but **NOT** both.
- vi) Where plant names are required, they should include genus, species and where appropriate, cultivar.

Module A

**Plant Propagation,
Growing Media & Plant Nutrition**

**Sections B & C
Structured Questions**

Please turn over/.....

Section B – Plant Propagation

Answer **ONE** question only from this section

		Marks
Q1	a) Describe the main factors that contribute to high quality propagation composts for use by a professional grower.	14
	b) Explain, with reference to specific propagation facilities, how propagation composts may be adapted to take these factors into account.	6
Q2	a) Describe the preparation for EACH of the following types of cutting used in the propagation of woody shrubs, naming a plant example in EACH case: i) nodal tip; ii) stem section; iii) heel.	12
	b) Describe the main procedure to be followed in propagating a NAMED woody shrub from a heel cutting, up to but excluding the first potting stage.	8

Please see over/.....

Section C – Growing Media & Plant Nutrition

Answer **TWO** questions from this section

	Marks
Q3 a) NAME FOUR influences on the formation and development of soil in the United Kingdom.	4
b) For EACH of the main influences named in a), explain how EACH one results in the formation and development of soil.	16
Q4 a) State FOUR reasons for the addition of lime (calcium) to a soil, or growing medium.	4
b) Review FOUR materials and methods for raising the pH to obtain optimum growing conditions.	8
c) Evaluate TWO materials and methods for lowering soil pH to obtain optimum growing conditions.	8
Q5 Evaluate a range of growing media and mixes suitable for EACH of the following stages of plant production:	
i) raising plants from seed;	5
ii) propagating by cuttings;	5
iii) potting off young plants;	5
iv) potting on plants.	5

Please turn over/.....

	Marks
Q6 Alternative materials may lessen the impact on the global environment and reduce the horticulturists' demands on peat but they are not without risk.	
a) List SIX peat alternatives and state the health and safety considerations associated with the use of EACH one.	12
b) State THREE precautions that should be taken when handling composts, or products that contain harmful pathogens.	3
c) State THREE precautions that should be taken when handling dusty materials that may be irritating, or contain fungi.	3
d) State the precautions that need to be taken when handling any TWO of the peat alternatives listed in a).	2



RHS (LEVEL 3) ADVANCED CERTIFICATE IN HORTICULTURE WRITTEN EXAMINATION

Tuesday 4th July 2006

Module A

Plant Propagation, Growing Media & Plant Nutrition

Examiners Report

Candidates Registered	320		Total Candidates Passed		
Candidates Entered	251	78.44%	Passed with Commendation	39	15.54%
Candidates Absent	40	12.50%	Passed	138	54.98%
Candidates Deferred	9	2.81%	Failed	74	29.48%
Candidates Withdrawn	20	6.25%			

It is of vital importance that candidates practice examination technique. It is obvious from candidate responses that some centres delivering the qualification are not paying sufficient attention to this important aspect.

It is of equal importance that candidates make themselves familiar with the meaning of the key words used in questions. Lengthy short answers generally indicate that candidates have failed to correctly interpret the question, in the majority of instances they have not understood what type of response is actually required. E.g. in context 'Explain' requires candidates to 'make the meaning clear'; when the question asks you to list, state or name then that is **all** you have to do. There were occasions where candidates gave answers that were excessive and contained information that was quite far removed from the scope of the question set.

In some instances handwriting again proved difficult to decipher. Candidates must remember that if the examiner cannot read what has been written the award of any marks is impossible.

On a positive note it was pleasing to observe candidates offering more examples to back up their answers, these help to confirm understanding and enable examiners to be more generous within the constraints of their marking schemes.

In general many of the answers presented by candidates were of a good standard and provided satisfactory evidence of good understanding and knowledge of the science and practices underlying horticulture.

While in most cases the answers presented directly reflected the question set in the paper there were occasions where it was obvious that candidates had either not read or not fully understood the question they had been set.

Where the question asks for plant names they should be quoted in full. It is not acceptable to merely suggest sp. is a suitable plant; species vary within a genus and it is necessary to be specific.

Section A – Short Answer Questions

- Q1** Name **TWO** plant seeds that require light to germinate and **TWO** plant seeds that require darkness to germinate.

The question required candidates to write the names of plants in each case. It was pleasing that the majority of candidates were able to provide two names in each case. Regrettably some candidates did not clearly differentiate between those that require light to germinate and those that require darkness, which made it impossible to award any marks.

- Q2** Explain the difference between the terms 'scarification' and 'stratification' in relation to plant seeds.

Candidates were asked to explain the difference (**make the difference clear**). Those that explained scarification as 'abrasion of the seed coat to allow imbibition of water' by any accepted method; and stratification as 'subjecting the seed to moist/warm, moist/cool storage to break dormancy' by any accepted method were awarded full marks.

- Q3** **NAME FOUR** essential components of a mist unit, stating the function of **EACH**.

From candidate responses it was obvious that many were not conversant with standard industry equipment. It should be noted that the question asked for '**FOUR essential components**', many candidates named components that were not essential and incorrectly stated the function. Candidates who named four essential components, ie mist head, sensor, solenoid valve and basal heat source accompanied by a correct statement of function were awarded full marks.

- Q4** State the use of **EACH** of the following types of graft providing an appropriate **NAMED** plant example in **EACH** case:

- iii) side-veneer graft;
- iv) whip-and-tongue graft.

Many candidates incorrectly cited Rosa cultivars as plant examples; the majority of answers displayed a noticeable lack of subject knowledge. However some candidates achieved full marks by correctly stating an accepted use of each type of graft and were able to supply a good botanically correct plant example in each case.

Exemplar

A side-veneer graft is a bench graft used where a sap drawer is required and often where the scion material is thinner than a rootstock. E.g. Betula pendula 'Youngii'.

A whip-and-tongue graft is used where additional graft union strength is required. E.g. over grafting Malus domestica 'Discovery' bud failures in a field situation.

Q5 *Explain the difference between the soil air and water relationships in a sandy soil as compared with a clay soil.*

It was pleasing to note that the vast majority of candidates were able to clearly explain the differences and received full marks.

Q6 *Explain **FOUR** methods by which nutrients can be permanently, or temporarily, lost from soil, or growing media.*

In most instances candidates listed all the methods by which nutrients can be permanently, or temporarily, lost from soil, or growing media, but did not provide explanations. The question required each of the methods to be explained, i.e. In clear terms how nutrients could be permanently, or temporarily, lost from soil, or growing media. Candidates who successfully explained four methods received full marks.

Q7 *State with reasons **TWO** positive and **TWO** negative effects of cultivation in soil structure.*

It was pleasing to note that the majority of candidates were able to correctly state **TWO** positive and **TWO** negative effects of cultivation on soil structure and provide valid reasons. A wide range of answers were accepted and full marks were awarded in the majority of cases.

Q8 *Explain the role of nitrogen in the metabolism of a plant.*

It was evident from the answers to this question that the majority of candidates understood the basic role of nitrogen in the metabolism of a plant. Candidates who were able to provide a more detailed explanation that included four of the following were given full marks.

Nitrogen is used within the plant for the **synthesis of amino acids, proteins, chlorophyll, nucleic acids and co-enzymes**

Q9 *Define the term 'Law of Limiting Factors' in relation to growth development.*

Candidates provided a range of answers. Those who defined the law of limiting Factors as; '**Where plant growth is constrained by the lack of an essential element that is the most limiting cause**', received full marks.

It was pleasing that some candidates offered an example to support their definition and in some cases where the definition was weak, the example confirmed understanding and marks were awarded.

Q10 *Define the technique 'Aeroponics' and state how it may be used to propagate plants.*

A number of candidates were able to correctly define the term 'Aeroponics' ,but few were able to go on and state how it may be used to propagate plants. Many answers referred to Air layering which was incorrect.

Exemplar

Aeroponics can be considered a modified form of hydroponics. For aeroponic propagation, **the 'cutting' is supported in a chamber, the base/root system is left hanging in the air but keep moist by regular spraying of droplets of liquid nutrient to the base / roots.** A high-pressure pump and atomiser nozzle is normally employed for this purpose.

Section B – Plant Propagation

- Q1**
- a) *Describe the main factors that contribute to high quality propagation composts for use by a professional grower.*
 - b) *Explain, with reference to specific propagation facilities, how propagation composts may be adapted to take these factors into account.*

This question combines theory with practical experience and candidates demonstrating a good grasp of both produced the best answers.

a) Most candidates scored well in this section. The key to scoring well was to concentrate on the words 'propagation composts' and 'professional grower'. Too many candidates moved away from the question and started talking about composts in general and did not always express a full appreciation of the needs of a professional grower. Many candidates used words such as 'appropriate' and 'relevant', an example being, cutting composts require an appropriate pH to avoid the locking up of nutrients. To score full marks candidates need to be clearer and offer specific pieces of information.

b) Most candidates failed to read the question thoroughly and continued to write about composts in general with very few candidates relating their answers to specific propagation facilities. To gain full marks the candidate needed to select a couple of contrasting facilities such as a mist and fogging units and explain how the different propagation environments effect the make up of a media.

- Q2**
- a) *Describe the preparation for **EACH** of the following types of cutting used in the propagation of woody shrubs, naming a plant example in **EACH** case:*
 - i) Nodal tip cutting
 - ii) stem section;
 - iii) heel.
 - b) *Describe the main procedure to be followed in propagating a **NAMED** woody shrub from a heel cutting, up to but excluding the first potting stage.*
- a) a) In most, but not all, cases candidates were able to explain the difference between the cutting types but very few went on to explain the advantages of selecting one type over the other. Candidates who provided the correct information on each cutting type gained full marks. When asked to provide a 'named plant' candidates must provide the full botanical name.

The key to scoring well is to understand what the examiner is looking for, from each section. Focussing in on the cutting type is crucial to score well in part a) Many candidates showed only partial understanding and produced the following type of answer when describing for example, nodal tip cuttings. 'For this type of cutting take below a node.' While this is correct, it does not tell the examiner what or where a node is and why you might make a cutting of this type. The three parts of a) each attract four marks. It is not necessary therefore to write the full propagation and production schedule of the named example. Many candidates did.

b) Some candidates had exhausted their knowledge on completion of a) then found it difficult to reproduce a detailed answer in part b) As b) attracts twice the number of marks compared to an individual section within a), answers need to reflect this in their length and depth. Answering the question is important as marks are only awarded for information 'up to but not including the first potting stage of the named shrub.'

Section C – Growing Media & Plant Nutrition

- Q3** a) **NAME FOUR** influences on the formation and development of soil in the United Kingdom.
- b) For **EACH** of the main influences named in a), explain how **EACH** one results in the formation and development of soil.
- a) A full range of influences were named, including: Biological, Chemical & Physical Weathering; Erosion; Human Activity & Topography. However, strong linkage was looked for with Section (b) & this was an area for improvement. Those that were named in (a) should then be fully explained in (b).
- b) The development & formation of soils, using the methods in section (a), were sometimes given in outline only & required an explanation, in which, the resulting soil type produced should have been named, eg. Chemical Weathering & its relation to the production of Rendzina type profiles. A wide range, with & without named soils and areas where found, were given, but the weather conditions & sites named should be from within the UK, as stated in section (a) of the question. Other points of confusion were noted as: **Micro-organisms** do not include Earthworms. **Rainfall** is naturally acidic with Carbonic acid being produced from Carbon Dioxide. **Acid Rain** is the term used when the acid being produced is Sulphuric; due to a higher level of pollution causing increased sulphur levels in the air.

- Q4**
- a) *State **FOUR** reasons for the addition of lime (calcium) to a soil, or growing medium.*
 - b) *Review **FOUR** materials and methods for raising the pH to obtain optimum growing conditions.*
 - c) *Evaluate **TWO** materials and methods for lowering soil pH to obtain optimum growing conditions.*
- a) A good range of reasons for the addition of Lime (Calcium) were stated, such as:
 - i. to raise the soil pH.
 - ii. to flocculate soil particles.
 - iii. to supply Calcium as a plant nutrient.
 - iv. to allow the release of trace elements, eg. Magnesium, for use by plants.
 - b) A wide range of materials were included for this section, including: Calcium carbonate; Calcium hydroxide; Calcium oxide; Calcium magnesium carbonate & Calcified Seaweed. However, less importance was given to the possible methods available. General terms were used, eg. Mulching, but the material used or timing of application was missing.
Spent Mushroom Compost has little effect on pH, as now a neutral casing agent is usually used.
The Health & Safety requirements of some recommended products, eg. Calcium oxide, were not highlighted, ie. that it should not be generally used due to its caustic reaction to water & the heat given off.

Other points of note were:
Neutralizing Values were included, but not reviewed as to their importance, ie. the quality of the material selected & the resulting amount required of each to obtain the same adjustment of pH.
Chalk & Ground limestone are names for the same material. **Dolomitic Limestone** is another form of Calcium magnesium carbonate, which should contain a higher level of Magnesium, than Magnesium Limestone.
 - c) The evaluation within this section was mixed, with the emphasis given to purely naming two materials.
Not all Organic matter is acidic or will have an acidic effect to alter soil pH.
Leaf mould depends on the pH of the soil where the plants were grown.
Peat is not always acidic & so required more detail of the type than just general naming, eg. Sphagnum Moss Peat should be given.
Some confusion was shown with the use of Sequestrene products of Chelated Iron & lowering pH. Sequestrene supplies Iron, which is then available to the plant & has a minimal effect on media pH.

Also less detail & time was usually spent on this section, although eight marks were available for evaluating two items.

- Q5** Evaluate a range of growing media and mixes suitable for **EACH** of the following stages of plant production:
- i) raising plants from seed;
 - ii) propagating by cuttings;
 - iii) potting off young plants;
 - iv) potting on plants.

This question did not require details of seed sowing, propagation and potting up/potting on procedures or techniques.

Candidates gaining the highest marks were those who, for each of the sections, clearly evaluated the appropriate alternative media and mixes, ie : they identified the strengths and weaknesses of each and its suitability for the task, supporting this with the reasons.

While many of the characteristics of growing media were common to all sections of the question, eg structure, pH, moisture retentiveness and drainage, the appropriateness of different media/components varies according to whether seeds are being sown, cuttings rooted or plants potted. Only the candidates gaining the highest marks were able to identify this and to explore the reasons why.

Seed sowing: Reference should have been made to the need for the medium to have an appropriate pH with examples of how this is achieved and the effect of the pH on available nutrient levels.

Few candidates mentioned the need for reduced nutrient levels in seed compost and even fewer explained why this was so. Rarely did candidates refer to the buffering effect of loam on nutrient content and availability within a mix.

For highest marks candidates should have included reasons for sterile, even and uniform mixes, the need for moisture retention but adequate drainage and for a structure which did not lead to capping, and which allowed effective radicle penetration and seedling support.

Cuttings: The importance of the air/moisture/pH combination at the base of the cutting as an aid to callusing and root initiation was addressed by few candidates. While many stated that the mix needed to be well drained and moisture retentive there were few explanations of why this was so. Only rarely was mention made of the suitability of different mixtures for mist or closed case propagation techniques.

While many candidates identified a range of media and mixes for rooting cuttings, few evaluated them: their answers being either a list of characteristics or at best a description.

Potting off/Potting on: These sections provided candidates with the opportunity to demonstrate their knowledge of nutrient availability within a range of media and to explore the advantages and disadvantages of different components and mixes in relation to this.

The effect of loam on nutrient retention and availability within composts/media and the implications of this in relation to plant nutrition when using loam-based or loamless composts was a critical component of these two sections.

Many candidates identified weight as a disadvantage of loam based composts, but few identified it as an advantage, preventing wind blow, when potting large specimens that would be stood out in the open.

The need for specialist formulations for ericaceous plants was mentioned by few candidates and the means by which they were achieved by even fewer.

Q6 *Alternative materials may lessen the impact on the global environment and reduce the horticulturists' demands on peat but they are not without risk.*

- a) *List **SIX** peat alternatives and state the health and safety considerations associated with the use of **EACH** one.*
- b) *State **THREE** precautions that should be taken when handling composts, or products that contain harmful pathogens.*
- c) *State **THREE** precautions that should be taken when handling dusty materials that may be irritating, or contain fungi.*
- d) *State the precautions that need to be taken when handling any **TWO** of the peat alternatives listed in a).*

- a) Candidates who achieved the highest marks for this questions were those who correctly identified six peat alternatives, (eg: coir, bark, garden compost, spent mushroom compost, composted municipal waste, treated sewage sludge, straw, seaweed, vermiculite, perlite, and animal manures), and then gave details of the health and safety considerations related to each.
- b) Most candidates were able to identify three precautions to be taken when handling composts that contained harmful pathogens, although many omitted to state that tetanus injections should be kept up to date. Suitable precautions including protective clothing, no eating, drinking or smoking while working with these materials and washing after work, and avoid contact between materials and eyes, mouth or open sores/wounds.
- c) Most candidates were able to identify three precautions to be taken when handling dusty composts or materials that may contain fungi, or be irritating. Answers given included wearing gloves, dust masks or respirators and coveralls, and damping down the materials.
- d) This part of the question was invariably well answered in relation to the two substances chose.

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