Candidate Number:……

Candidate Name:……

Centre Number/Name:……

RHS LEVEL 3 ADVANCED CERTIFICATE IN HORTICULTURE
WRITTEN EXAMINATION

10:00am Tuesday 3rd July 2007

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 metric measurements **ONLY**.
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 FOUR** possible causes of soil surface water run off. **2**

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Q2 Describe **FOUR** features of the soil survey and supporting Her Majesty's Stationery Office (HMSO) maps. **2**

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Q3 Define the term Cation Exchange Capacity (CEC), in relation to mineral soils. **2**

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Q4 Name **FOUR** soil structure classifications. **2**

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Please see over/…..

ANSWER ALL QUESTIONS

MARKS

Q5 State the benefits which mycorrhiza may have on the healthy growth of plants. **2**

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Q6 State **FOUR** methods that may be used to overcome the problems of dormancy caused by a hard seed coat. **2**

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Q7 State **FOUR** reasons for carrying out the routine care of stock plants. **2**

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Q8 State **TWO** physiological processes that lead to the successful germination of seed. **2**

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Please turn over/.....

ANSWER ALL QUESTIONS

MARKS

Q9 State **FOUR** methods used for determining the nutrient status of a plant. **2**

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Q10 a) State the main difference between the terms ‘risk’ and ‘hazard’.

b) State **TWO** risks, which may be encountered when using a knife in the propagation of plants by cuttings. **2**

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RHS LEVEL 3 ADVANCED CERTIFICATE IN HORTICULTURE
WRITTEN EXAMINATION

10:00am Tuesday 3rd July 2007

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 metric measurements **ONLY**.
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) Explain why it is important to maintain hygiene and optimum storage conditions for seed. **8**

b) Describe how storage conditions affect the maximum viability of seed. **4**

c) Describe the preparation for storage and the maintenance of ideal conditions for maximum viability of a **NAMED** native **OR** naturalised tree seed. **8**

Q2 a) List **FIVE** distinct propagation techniques used for multiplying herbaceous perennials. **5**

b) Explain the reasons for using **EACH** technique listed in a). **10**

c) Name **ONE** plant propagated by **EACH** of the techniques listed in a). **5**

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Please see over/…..

Section C – Growing Media & Plant Nutrition

Answer TWO questions only from this section

MARKS

Q3 a) State the meaning of plant nutrient indices. **2**

b) Explain how nutrient indices are used as guidance for the establishment of crops. **10**

c) Evaluate the use of nutrient indices in the calculation of fertiliser requirements. **8**

Q4 a) Describe the changes, which occur as a growing medium dries from a saturated state, and how these may affect the growth of plants. **10**

b) Explain how field capacity affects the water availability for plants in **EACH** of the following types of soil:

i) sandy; **3**
ii) clay. **3**

c) Relate the water holding capacity for **EACH** of the soils named in b), to their workability. **4**

Q5 a) Describe **FOUR** different sites where soil restoration will be necessary prior to horticultural use. **8**

b) Review appropriate techniques for reclaiming **EACH** of the sites described in a). **12**

Q6 a) Evaluate media ingredients and mixes available for **EACH** of the following types of compost:

i) Seed; **5**
ii) Cutting; **5**
iii) Potting. **5**

b) Evaluate the characteristics of materials available for soil improvement when growing calcifuges. **5**

RHS LEVEL 3 ADVANCED CERTIFICATE IN HORTICULTURE WRITTEN EXAMINATION

Tuesday 3rd July 2007

MODULE A

Plant Propagation, Growing Media & Plant Nutrition

Examiners Report

Candidates Registered	166				
			Total Candidates Passed		
Candidates Entered	134	80.72%	Passed with Commendation	70	52.24%
Candidates Absent	24	14.46%	Passed	50	37.31%
Candidates Deferred	8	4.8%	Failed	14	10.45%
Candidates Withdrawn	0	0%			

Section A – Short Answer Questions

Q1 **NAME FOUR** possible causes of soil surface water run off.

The question required candidates to 'name' four possible causes of soil surface run off, not to provide either a description or explanation. Where this information was provided, it confirmed understanding, but no additional marks could be awarded.
Without exception the majority of candidates were able to provide a good response and were awarded full marks. Acceptable answers included the following;-

Capping of the soil
Surface compaction
Sub surface compaction
Soil / mineral pans
Heavy rainfall
Removal of plant material on a slope
Ploughing down hill, instead of across a slope
Excessive irrigation
Soil being at field capacity
Dry soils note being able to absorb rainfall until wetted

A half mark was awarded for each correct one to a maximum of two marks.

Q2 Describe **FOUR** features of the soil survey and supporting Her Majesty's Stationery Office (HMSO) maps.

This question required candidates to 'describe' (provide an account) four features of the soil survey and its supporting maps as supplied by Her Majesty's Stationary Office (HMSO).

Many candidates were unable to successfully interpret the question and supplied answers based on how to carry out a soil survey or did not know of the existence or the format of this resource.

An account of the features of the soil survey and supporting maps could include the following;

- **soil types are colour coded for ease of identification**
- **there is linkage of soil types in groups (again by colour)**
- **classification of soil types are provided**
- **suitability (including topography) of use is provided in the legend**
- **recommended main cultivation periods are given**
- **areas of disturbed soils are shown**
- **the profile details for common soils are provided**
- **important soil properties are given in the legend, including conditions affecting rooting depth, cultivation and drainage**
- **underlying geological influences are provided in the legend**

A half mark was awarded for each correct one to a maximum of two marks.

Q3 Define the term Cation Exchange Capacity (CEC), in relation to mineral soils.

The question required candidates to provide a definition (make the meaning clear) of the term Cation Exchange Capacity (CEC), in relation to mineral soils.

The majority of candidates showed an understanding of the principles of CEC and gave an account of what CEC was, however very few were able to provide a precise or clearly understandable definition.

The examiner required; - **'CEC is a measure of the amount of exchange of negative mineral ions available per unit of soil'.**

Q4 Name **FOUR** soil structure classifications.

The question was very straightforward; it required only four correct names of soil structure classifications. Regrettably the majority of candidates either misread the question or were confused.

Many candidates provided answers based on the names of textural classes e.g. Sand, Silt, Clay etc. or geological terminology relating to parent materials.

Successful answers could have included any of the following classifications;-

Spheroidal - Granular, porous
Spheroidal - Crumb, very porous
Plate like
Block like - angular blocky
Block like - Sub-angular blocky
Prismatic - Columnar (rounded tops)
Prismatic - Prismatic (flat, angular tops)
Massive (one large ped)

A half mark was awarded for each correct one to a maximum of two marks.

Q5 State the benefits which mycorrhiza may have on the healthy growth of plants.

The question required candidates to state (provide short statements) of the benefits which mycorrhizas have on the healthy growth of plants.

Many candidates stated what mycorrhizas were in terms of them being beneficial fungi that form synergistic relationships with plants. Many explained how they worked in great detail. However it was the candidates that stated the benefits which mycorrhiza have on the healthy growth of plants that received full marks.

These benefits could include;-

- **fixing of nitrogen gas making nitrogen more readily available to the plant**
- **making phosphorous more available to the plant**
- **increasing the area of plant roots via hyphae (fungal strands) improving water availability**
- **increasing the area of plant roots via hyphae (fungal strands) improving nutrient availability**
- **the blocking of adverse pathogens ensuring plant health**
- **adding to humic content of the soil encouraging healthy bacterial activity**

A half mark was awarded for each correct one to a maximum of two marks.

Q6 State **FOUR** methods that may be used to overcome the problems of dormancy caused by a hard seed coat.

The question required candidates to state (provide short statements) relating to four methods that may be used to overcome dormancy caused by a hard seed coat. It was pleasing to note that the majority of candidate correctly interpreted this question and were able to provide answers that warranted full marks.

Successful answers included some of the following;-

- **Stratification - moist, cold and warm through biological action on the seed coat**
- **Scarification – chipping, filing, cracking, nicking, abrasion by acid, sandpaper etc to breakdown the seed coat**
- **Harvesting seed before the seed coat fully ripens**
- **Hot water treatment to soften the testa.**
- **Soaking in various substances, water, acetone, alcohol, various acids to soften or weaken the testa**
- **Heating by fire to crack seed coat**

A half mark was awarded for each correct one to a maximum of two marks.
It was pleasing to see candidates providing examples, although not specifically asked for they demonstrate full understanding to the examiner.

Q7 State **FOUR** reasons for carrying out the routine care of stock plants.

The majority of candidates successfully interpreted this question gaining full marks, although a small number confused the term ‘stock’ with an alternative meaning i.e. product for sale.

Suitable answers included some of the following statements;-

- **to apply plant protection materials to keep plants free from pests (vectors carrying viruses or disease)**
- **to apply plant protection materials to keep plants free from diseases that would reduce healthy growth and inhibit successful propagation**
  to apply weed control materials to ensure stock plants do not suffer from weed competition
- **to prune plant to remove dead, diseased, damaged and non typical growth**
- **to prune plants at the appropriate time of year to maintain juvenility**
- **to prune plants at the appropriate time of year to ensure the availability of suitable quality material for propagation purposes**
- **to carry out essential maintenance e.g. weeding**
- **to carry out essential maintenance e.g. feeding**
- **to apply water to ensure that plant do not suffer adverse effects**
- **to pot on containerised material**

A half mark was awarded for each correct one to a maximum of two marks.

Q8 State **TWO** physiological processes that lead to the successful germination of seed.

Regrettably only a limited number of candidates were able to successfully interpret and answer this question.

The examiner was expecting responses as follows;-

- the **imbibition** of water by **osmosis**
- increased **respiration** triggered by **enzyme activity**
- rapid **cell division** and **differentiation**

Q9 State **FOUR** methods used for determining the nutrient status of a plant.

Many candidates included references to pH, conductivity of soil and the nutrient status of the soil, which were not relevant to the question asked. Some candidates include within their answers reference to testing the nutrient content of fruit to reduce storage disorders and longevity of storage, understandable but, it would not be a good indicator of nutrient levels in the whole plant.

The stated methods could have been any of the following;-

- **visual inspection to look for signs of deficiency**
- **visual inspection to look for signs of excess**
- **a sample of tissue taken for analysis in a laboratory to determine nutrient content**
- **leaf analysis from a representative sample in a laboratory to determine nutrient content**
- **sap analysis from a representative sample in a laboratory to determine nutrient content**

Q10 a) State the main difference between the terms ‘risk’ and ‘hazard’.

Part a.) of this question required candidates to provide a statement which clearly showed the difference between the terms ‘risk’ and ‘hazard’. It was evident that the majority of candidates understood the question, but were unable to provide a short statement which clearly showed the difference. Candidates who were able to provide a suitable statement or were close, were awarded full marks. A suitable statement would be similar to:-

‘Risk is the chance of an occurrence and a hazard is anything that could conceivable cause harm’.

b) State **TWO** risks, which may be encountered when using a knife in the propagation of plants by cuttings.

Part b.) of this question required candidates to state two risks which may be encountered when using a knife in the propagation of plants by cuttings. The 'risks' relate to the person or other people mainly from receiving wounds or conceivably contracting infection or disease as a result. The risks do not relate to the material being propagated. Therefore candidates who offered any suitable answers relating to the risks to people received full marks.

Structured Questions
Section B – Plant Propagation

Q1 a) Explain why it is important to maintain hygiene and optimum storage conditions for seed.

b) Describe how storage conditions affect the maximum viability of seed.

c) Describe the preparation for storage and the maintenance of ideal conditions for maximum viability of a **NAMED** native **OR** naturalised tree seed.

Only 24% of candidates attempted this question. Those that did generally answered the question well. Some students had difficulty understanding the first two parts of the question and in each case provided information about storage conditions rather than explaining why it is important to maintain…or how storage conditions affect…..
In section C the student is asked to provide information about a named native or naturalised tree seed. In this situation it is important not just to write English Oak or conker but to provide the full Latin name of the chosen example, i.e Quercus robur or Aesculus hippocastaneum.

All of the many students who went on to describe the propagation of their chosen tree example received no additional marks for providing this information. It cannot be stressed often enough that students need to read questions and gain a clear understanding of what is being asked of them before putting pen to paper.

Q2 a) List **FIVE** distinct propagation techniques used for multiplying herbaceous perennials.

b) Explain the reasons for using **EACH** technique listed in a).

c) Name **ONE** plant propagated by **EACH** of the techniques listed in a).

76% of candidates attempted this question. This was generally well answered. Those candidates who choose five distinct propagation techniques gain full marks. Candidates including for example three types of cuttings i.e soft, semi ripe and hardwood would only gain one mark as these are not considered sufficiently distinct from one another.

When asked to explain the reason for using each technique those students who then described the technique in detail would receive full marks. For example, for either rhizome cuttings or division Bergenia cordifolia ‘Silberlicht’ would gain a full mark but where candidates write bergenia only a half mark was awarded.

Section C – Growing Media & Plant Nutrition

Q3 a) State the meaning of plant nutrient indices.

Most responses gave a clear meaning of the phrase, eg. A method of standardizing the current nutrient status of a media for a number of different nutrients, eg, Phosphorus, Potassium & Magnesium. Also the required level pre- establishment & for topdressing.

b) Explain how nutrient indices are used as guidance for the establishment of crops.

A good level of explanation was recorded, eg. A shorthand method of stating nutrient status at the time of sampling. Each index is given on a scale from 0 to 9, with different amounts of nutrient used for the same level,depending on the nutrient & its requirement by the plant. Used as a media test for the current levels & a tool for stating how much is required for successful crop establishment (& top-dressing).
0 to 3 = the nutrient is deficient & requires more nutrient to be applied.
4 to 6= the nutrient is at satisfactory levels for the crop to be established & grown, without the need to add any further of that nutrient.
7 to 9= the nutrient is at toxic levels & may effect the uptake of other nutrients & the ease of the crop establishment. Action should also be taken, eg. Planting of a Green Manure, to reduce the nutrient level, before the required crop is used on that site.

c) Evaluate the use of nutrient indices in the calculation of fertiliser requirements.

Clear evaluation was provided, eg. It must be remembered that each Index is providing the required application level for that **pure** nutrient. Therefore further calculation is required from the supporting crop establishment table to obtain the correct fertilizer rate, depending on the level of nutrient found within the selected fertilizer, usually given as a percentage on the bag.
This can make the Indices of less use, as the rate on the supporting crop establishment table is thought to be the fertilizer rate.
However, clear information is provided at the middle & upper end of the scales, where fertilizers are not required for successful crop establishment.

General comments: For this series of questions a good level of response was shown, with most Candidates following the response required, eg. Evaluating the area required rather than just listing the main points. However, some very long responses were provided giving rise to an imbalance of detail between the two selected questions. Good time control / management within the Examination period still needs to be further practised & refined.

Q4 a) Describe the changes, which occur as a growing medium dries from a saturated state, and how these may affect the growth of plants.

A very full description was provided, but the statements made must relate back to the affect on the growth of plants, this was an area that was under developed. A balanced view was required, eg. When the soil is completely saturated all the pores are filled with water but as drying occurs first macropores then mesopores will drain the loss of this gravitational water draws air into the soil providing oxygen to the plant roots required for respiration and carbon dioxide required for photosynthesis exchange of gases takes place in aerobic conditions. If saturation continued, for some period, then anaerobic (without oxygen) conditions would remain, resulting in damage to plant roots and microfauna by the production of toxins and de-nitrification.

If drying continued Field Capacity would be obtained, which is the stage at which the maximum water is held after free drainage, and is the optimum point for plant growth. As water loss continues through evapo-transpiration, plant growth will become limited once wilting point is seen, the stomata will be closed and turgidity is lost. If no water were supplied, Permanent Wilting Point would result in death of the plant.

b) Explain how field capacity affects the water availability for plants in **EACH** of the following types of soil:

iii) sandy;
iv) clay.

A clear understanding of Field Capacity was required and that the point is the same for all media but the volume of water held is different, eg. Sandy: soil water drains very quickly and is not held, due to the amount of macropores, therefore the volume of water held at Field Capacity is lower. The maximum water will also only be available for a short period on this type of soil.

c) Relate the water holding capacity for **EACH** of the soils named in b), to their workability.
The link with workability of soils was requested, eg. Clay: difficult to work unless well structured and could be still plastic at field capacity resulting in a very short time period for cultivation, also still difficult to work when very dry, forming large hard clods.

Q5 a) Describe **FOUR** different sites where soil restoration will be necessary prior to horticultural use.

FOUR clear different sites were requested to be described, rather than just named on a list. As part of this the expected problems to be overcome should have been included, eg. High Nitrogen levels at the end of an intensive summer crop, or Heavy metal contamination, eg. Lead, from old mine workings.

b) Review appropriate techniques for reclaiming **EACH** of the sites described in a).

Direct linkage was required with the sites selected, with clear **appropriate** recommendations of how to overcome the problems. Too often the soil was just taken away and replaced with new or the pollutants were leached out and end up mixed into the ground water. The naming of plants for difficult sites was an opportunity often missed, as was the pre- testing of soil to confirm the problem and its extent before any work starts. To take the examples given above: media testing to establish the current Nitrogen level, then production of a short-term Green Manure, eg. White Mustard *(Sinapis alba)*, if required, to absorb the high level of nutrient before being incorporated as a base dressing for the next crop, eg. *Brassica spp.*
Heavy metal contamination:
The use of Phytoaccumulation, which is, establishing plant species, eg.Tomato *(Lycopersicon esculentum)* to store the metal within the root system and then harvest the crop, compost or burn off the plant material and retrieve the lead for reuse.

Q6 a) Evaluate media ingredients and mixes available for **EACH** of the following types of compost:

iv) Seed;
v) Cutting;
vi) Potting.

The evaluation of the requested media was very fully undertaken, however the inclusion of the materials and mixes were sometimes overlooked, especially the bulk products, eg. Loam, Peat and Bark.
For the use of sowing seed:

John Innes Seed Compost- 2 parts sterilised Loam; 1 part Sharp sand; 1 part
Peat; 0.6 kg Ground Limestone & 1.2 kg Superphosphate (Per cubic metre)

And

50:50 Sphagnum Moss peat / Sharp Sand, seed covered with Vermiculite.

And

25:75 Vermiculite / Sphagnum Moss Peat.

And a wide range of multipurpose composts could have been included.

All these mixtures should provide the following:

Correct pH for subject; be even and uniform; retain moisture to prevent drying out; sufficient air capacity; prevent capping, to allow the plumule to break the surface easily and to allow the radicle to penetrate for support and root development.

b) Evaluate the characteristics of materials available for soil improvement when growing calcifuges.

The term **Calcifuges** was understood in most responses; however the materials for soil improvement depend on your starting pH. Therefore, if an extreme acidic soil was being used Lime based products, especially Gypsum were recommended and were accepted. More common responses took the view that the soil pH was above 7 and so acidification was required, eg. Flowers of Sulphur and sulphur Chips;Composted Bark Chips; Composted Pine Needles; Oak Leaf Mould and acidifying fertilisers, eg. Ammonium Sulphate were all evaluated.

With the use of Chelated materials, eg. Iron Sequestrine, this makes Iron available to the plant, rather than changing the pH, but will improve calcifuges growth.

Also most stocks of Spent Mushroom Compost are now neutral but please check with the supplier before obtaining it for this use.