Candidate Number: ……..

Candidate Name: ……...

Centre Number/Name: ……

RHS LEVEL 3 ADVANCED CERTIFICATE IN HORTICULTURE
WRITTEN EXAMINATION

Tuesday 5 July 2005

IMPORTANT – Please read carefully before commencing.

i) The duration of the papers in Module **B** 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 space provided.
v) Use **EITHER** metric **OR** imperial measurements, but **NOT** both.
vi) Where plant names are required they should include genus and species.

Module B

Plant Taxonomy, Morphology & Anatomy
Plant Health
Plant Physiology

Section A – Short Answer Questions

Please turn over/……

Answer All questions. **Marks**

Q1 List the development stages of a **NAMED** insect pest which exhibits complete metamorphosis. **2**

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Q2 State **FOUR** requirements for accurately calibrating a knapsack sprayer.

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Q3 Explain the use of **EACH** of the spray jet nozzles listed:

i) deflector jet;
ii) hollow cone;
iii) even flat fan
iv) full cone. **2**

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Please see over/…….

Answer All questions **Marks**

Q4 Describe the visual symptoms for **EACH** of the following plant/crop problems:

i) scale insect;
ii) honey fungus;
iii) fasciation;
iv) tomato mosaic virus. **2**

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Q5 List **FOUR** requirements under the Food & Environment Protection Act (FEPA) 1985. **2**

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Q6 Define the term ‘plant tropism’. **2**

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Pllease turn over/……

Answer All questions

Marks

Q7 State the factors which control the opening and closing of stomata in plants. **2**

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Q8 **State** FOUR **physiological reasons for the deterioration of cut flowers after harvest.** **2**

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Q9 State the effects of diurnal changes on photosynthesis. **2**

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Q10 State **TWO** biological effects of partial soil sterlisatrion. **2**

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RHS LEVEL 3 ADVANCED CERTIFICATE IN HORTICULTURE
WRITTEN EXAMINATION

Tuesday 5 July 2005

IMPORTANT – Please read carefully before commencing.

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

Module B

Plant Taxonomy, Morphology & Anatomy
Plant Health
Plant Physiology

Sections B, C & D

Structured Questions

Please turn over/……

Section B – Plant Taxonomy, Morphology & Anatomy

Answer ONE question from this section.

			Marks
Q1	a)	Define the term inflorescence.	**2**
	b)	Using a **NAMED** plant example together with clear line diagrams, describe **SIX** types of inflorescence.	**12**
	c)	Describe how the type of inflorescence affects the ornamental value of plants.	**6**
Q2	a)	Describe the tissues found in a typical young dicotyledon root, with the aid of a diagram.	**14**
	b)	Describe how the structure changes as a result of secondary thickening in the root.	**6**

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Please see over/…….

Section C - Plant Physiology

Answer ONE question from this section.

Marks

Q3 a)

b)

Q4 a)
b)
c)

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Please turn over/…….

Section D – Plant Health

Answer ONE question from this section.

			Marks
Q5		Describe the symptoms of damage, life cycle and treatment of **TWO** named plant parasitic nematodes (eelworms).	**20**
Q6	a)	Describe the effects of the Plant Protection Products Directive (European Council Directive 91/414/EEC) and its impact on the use of plant pesticides within the EU.	**12**
	b)	List the requirements of a storage facility used to hold small quantities of pesticides.	**8**

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RHS (LEVEL 3) ADVANCED CERTIFICATE IN HORTICULTURE

Tuesday 5th July 2005

MODULE B

Plant Taxonomy, Morphology & Anatomy
Plant Heath
Plant Physiology

Examiners Comments

Candidates Registered	274		Total Candidates Passed		
Candidates Entered	228	83.21%	Passed with Commendation	15	6.58%
Candidates Absent	31	11.32%	Passed	103	45.17%
Candidates Deferred	6	2.19%	Failed	110	48.25%
Candidates Withdrawn	9	3.28%			

Senior Examiners Comments

Structured questions do not require candidates to write in essay form. It is important that candidates answer questions in a style that is appropriate to the question asked. This requires an understanding of the phraseology used.

It is of vital importance that candidates understand the meaning of the key words used in examination questions and respond accordingly. In many instances full marks could not be awarded because candidates had not understood what was required and as a result did not provide an answer that met the question in full, and thus failed to gain the available marks.

Below is provided a definition of the key words used in questions, which may help to clarify the requirement of questions.

State means - ***to write down the facts briefly***

Describe means – ***to give an account of***

Explain means – ***to make the meaning clear – (****answers will normally need to include details of how, when, why and to relate horticultural practice to underlying scientific principles).*

Evaluate means - ***to judge the worth of (state the benefits and limitations of..)***

List means – ***to itemise***

Diagrams must be annotated if they are to be of any value. It is advisable (but not essential) to draw them in pencil as mistakes can easily be rectified. The use of colour is a luxury and should only be carried out when clear differentiation is required.

In some instances handwriting again proved to be difficult to decipher. Candidates should remember that if the examiner cannot read what has been written it will not be possible to award any marks.

Wherever possible, named examples should be given in answers as these indicate to the examiner that the candidate has a comprehensive understanding of the subject concerned.

Where a question is set in different sections, eg a,b,c or i,ii,ii candidates are advised to set out their answers to follow the structure of the question, section by section.

Section A. Short Answer Questions

*Q1. For a **NAMED** insect pest that exhibits complete metamorphosis, explain how chemical control is related to the appropriate stages within its life cycle.*

Candidates frequently and wrongly named insect pests belonging to the incomplete metamorphosis group, e.g. aphids. Candidates gaining most marks were able to relate the mode of action of chemical pesticides, e.g. contact, residual, systemic, compost incorporated, etc. to the stage(s) of the insect's life-cycle when they would be most successful. Some candidates failed to gain full marks when they identified only one life-cycle stage for control, when in fact, more than one stage could be targeted by chemical pesticides. For example, vine weevil was correctly identified as having a complete metamorphosis and candidates correctly referred to larval control with compost drenches, or incorporated materials, but many failed to refer to possible control of adults with contact residual pesticides. Overall, the question was answered satisfactorily but there was a weakness in identifying insect pests exhibiting complete metamorphosis.

*Q2. State **FOUR** requirements for accurately calibrating a knapsack sprayer.*

The question was aimed at identifying four of a number of essential requirements necessary for accurate calibration of a knapsack sprayer. It is assumed that the knapsack is in good operational order and that users wear the appropriate personal protective (PPE) equipment. Those parts of answers referring to repairs, or need for PPE, were not awarded marks. Generally, candidates had a sound knowledge of the factors necessary for accurately calibrating knapsack sprayers which include: calculation of area of ground to be sprayed; volume of spray to be applied per unit area; maintain constant even pressure; known forward (walking) speed; nozzle output; spray application width, etc. Marks were apportioned for wrong parts to answers but many candidates achieved full marks for this question.

Q3. Explain the role of the mitochondria in plant cells.

Marks were frequently lost by candidates describing the structure rather than the role played by mitochondria. Similarly, a number of candidates wrongly linked the role of mitochondria with plant processes other than those of cellular respiration. Those gaining full marks were able to link the role of mitochondria: as being sites of aerobic respiration where most of the chemical reactions related to this process take place; where organic compounds such as glucose are broken down to produce energy; sites where adenosine triphosphate (ATP) is synthesised; where energy is produced to fuel plant growth processes. Marks were given proportionate to answers provided and any correctly identified roles other than those above attracted marks.

Q4. Describe the visual symptoms for EACH of the following plant/crop problems:

i) scale insect;
ii) honey fungus;
iii) fasciation;
iv) tomato mosaic virus;

Candidates generally showed a good clear knowledge of these plant problems and most were awarded full marks.

i) Scale insect – marks were not awarded when candidates briefly stated 'honeydew and sooty mould' without any description of the scale insect itself as most sap suckers produce these symptoms. This description is insufficient to clearly link it with scale insect alone.

ii) Honey fungus – candidates in general well well-acquainted with the full range of symptoms exhibited by this common problem. Only a low number were unfamiliar with honey fungus and failed to gain marks here.

iii) Fasciation – most candidates gave accurate, clear descriptive answers to this identified problem. Those gaining full marks were able to describe fusing and flattening of stem/flower shoots sometimes associated with curling and twisting of the same. Marks were not awarded for inadequately descriptive answers such as 'abnormal shoot growth'.

iv) Tomato mosaic virus – description of the visual symptoms, particularly of the leaves, was adequately covered, but candidates were less aware of 'dry set', or fruit 'bronzing' symptoms associated with tomato mosaic virus infection. Marks were not awarded to candidates who confused this viral infection with symptom descriptions typical of bacterial and fungal infections.

*Q5. List **FOUR** aims of the Food & Environment Protection Act (FEPA) 1985.*

Too many candidates failed to gain full marks in this question and were unaware that the basic aims of the legislation is to "control the use of pesticides, with the aims of protecting human beings, creatures and plants, safeguarding the environment, ensuring safe, effective and humane methods of controlling pests and making pesticide information available to the public".
Candidates were not awarded marks when they referred to the controlling of pests and diseases under the Plant Health Act 1993 and the movement of plants between member EU states and third country (none EU) states. Similarly, the legislation is unconnected with organic production, or the achievement of organic status.
Those candidates who link the aims of the legislation with: the use, only of approved pesticide products; the need for a certificate of competence for those either applying, or storing pesticides and users complying with conditions of approval, etc. were awarded marks.

Q6. Explain the physiological causes of tropisms.

Candidates were generally well-versed in answering this question and this reflected good teaching practice. Those candidates who only described and named a number of different examples of tropisms failed to gain full marks. The question required a fuller explanation of the physiological causes which enable the tropisms to take place. Those gaining full marks were not only able to name and describe tropisms but were also able to explain the involvement of plant growth regulators, e.g. auxins, the conditions under which they appear, and how they accumulate in certain parts of plant tissue to trigger a tropic response.

Q7. Explain the environmental factors, which allow guard cells to control the opening and closing of stomata in plants.

Candidates frequently failed to gain marks by omitting to refer to the night/day environmental factor which has a well-documented effect in controlling the closing and opening of stomata. Similarly, candidates generally referred infrequently to the wind and atmospheric humidity factors which have an obvious affect in controlling stomata behaviour.
Marks were gained mostly when candidates referred to environmental factors such as temperature, gaseous levels, e.g. carbon dioxide within and external to the plant, the turgidity and flaccidity of plant tissue as influenced by soil water availability, or increasing water stress (drought) environmental factors. References to the influence of abscisic acid and the migration of potassium (k) ions into and out of guard cells was rewarded when explained in the context of environmental factors.

*Q8. State **FOUR** physiological reasons for the deterioration of cut flowers after harvest.*

Candidates should assume that cut flowers are placed in water as soon after harvest as possible in order to prolong their life. Marks were frequently not awarded when candidates failed to state precise reasons for flower deterioration, for example, wilting, or lack of water. Those who gained marks stated poor, or inadequate, water transport through cut flowers due to the blockage of the xylem vessels by air locks, or pathogen infection. Similarly, too few candidates made the link between ongoing respiration and restricted, or reduced rates of photosynthesis, not replacing adequately the sugars used up. Marks gained reflected candidate knowledge of cut flower deterioration due to the higher temperatures increasing the physiological processes of respiration and transpiration and accumulation of ethylene leading to premature inflorescence deterioration. Candidates appeared to know the answer to the question but failed to gain marks by not stating the physiological reasons for deterioration with sufficient clarity.

Q9. Explain the effect of diurnal changes on photosynthesis.

Many candidates did not understand that "diurnal changes" referred to day length changes which occur and have an influence on photosynthesis, in particular the change of light to dark and corresponding temperature differentials, etc. Some candidates referred to seasonal rather than day length changes and others wrongly linked the question set to photo-periodism.
Candidates gaining marks were able to refer to increasing rates of photosynthesis during daylight producing sugars for immediate use and surplus to storage sites; at the end of the daylight decreasing photosynthesis reducing to nil-photosynthesis after dark. References to temperature fluctuations in daylight hours affecting the rates of photosynthesis also attracted marks. Other valid effects given by candidates attracted proportionate marks.

*Q10 State **TWO** biological effects of partial soil sterilisation.*

Most candidates demonstrated a good working knowledge of the subject area and gained high marks for their answers. The question related to heat sterilisation of the soil rather than chemical treatments and candidates readily referred to biological effects such as insect pest, fungal and bacterial pathogen control. Many referred correctly to weed seed destruction and the survival of beneficial nitrifying bacteria.
A number of candidates only gave one biological effect instead of two with marks being apportioned accordingly. Other candidates were not awarded marks when they gave contradictory, or confusing answers.

Section B. Structured Questions (Plant Taxonomy, Morphology & Anatomy)

Q1. a) Define the term 'inflorescence'.

*b) Using a **NAMED** plant example together with clear line diagrams, describe **FOUR** types of inflorescence.*

*c) Using **NAMED** examples, compare and contrast the inflorescence of wind and insect pollinated flowers.*

The definition of inflorescence was usually well-known but a minority of candidates confused it with the flower itself.
The part of the question dealing with the different types of inflorescence was, in general, answered well. A range of types was clearly well-known, diagrams were usually good and students could give an appropriately-named example. Umbel and corymb were sometimes confused. The account of the capitulum of the Asteracae was not very clear, very few mentioning florets and many referring to involucral bracts, or ray florets, as petals. Some compound capitula were used as examples of umbel/corymb, e.g. Achillea, Liatris. The idea that the panicle is a raceme of racemes was not understood, hardly ever being shown as a determinate inflorescence.
The third part of the question caused problems since most students approached it as it were asking for the difference between insect- or wind-pollinated flowers instead of inflorescences. The question expected students to comment on, e.g. the advantages of massing many flowers together so as to give a stronger signal to pollinating insects (capitulum, umbel), or of having accessory bracts (Hydrangea). In wind pollination, reference could be made to catkins as a collection of male flowers to put in a position to catch the wind. Many students gained marks by correctly giving a named example of each type of pollination but it was surprising how often Taraxum officinale was used as an example of wind pollination. Similarly, some students confused pollen with seed.

Q2. a) With the aid of a clearly labelled diagram, describe the tissues found in a typical young dicotyledon root.

b) Describe how the structure changes as a result of secondary thickening in the root.

The description and drawing of the tissues of a young root was usually done well. The names of the most of the tissues were well-known and candidates were able to go on and give some further information about each, e.g. most named the endodermis and went on to mention suberisation and the casparian strip. The pericycle was probably the tissue that caused most difficulty both in the drawing and in further information, e.g. origin of secondary roots. The function of xylem and phloem was often stressed, sometimes in details, instead of their constituent cell types. Some students confused root and stem structure in the diagram.
The description of secondary thickening in the root was not always well described despite its similarity to the same process in the stem. However, too many referred to interfascicular cambium which is the description that can only be applied to the stem.

Section C. Structured Questions (Plant Physiology).

Q3. a) Define transpiration and state its importance to plant growth.

b) Explain the mechanism of stomatal opening, under the following:

i) Environmental stimuli;
ii) Stomatal structure;
iii) Water and solute movement.

*b) Describe **FOUR** practical measures for reducing transpiration rates in unprotected cropping situations.*

a) Candidates who considered all aspects of transpiration to include water loss from non stomatal areas, i.e. cutin lenticels and flowers gained higher marks.

b) Large-labelled diagrams very much assisted candidates' answers. The better candidates provided information on how the stomata opens and closes with clear reference to environmental stimuli.
The role of water and solutes, especially with the guard cells was important to record. Candidates who made reference to the role of potassium and plant hormones gained higher marks.

c) Candidates who provided practical methods to reduce transpiration were awarded higher marks. Many candidates provided very general answers with reference to protective structures. Candidates were awarded higher marks for practical methods which included:

- ∞ Windbreaks, or shelter breaks.
- ∞ Shelter from sun with geotextile material.
- ∞ Selecting sites for suitable crops.
- ∞ Maintaining an acceptable soil moisture deficit for the crop.

Q4. a) Describe the process of aerobic cellular respiration, outlining the biochemical pathways including the 'krebs cycle'

b) Explain how varying methods of storage and transportation can affect rates of respiration to enhance the shelf life and marketability of crops.

Part (a) was very well-answered by the majority of candidates. Candidates who could identify and explain the three main processes – glycolysis, krebs cycle and electron transport chain gained higher marks. Large clear and labelled diagrams assisted the answer and were awarded higher marks.
Part (b) was not answered efficiently by any candidate. The question was designed to review storage considerations such as: vacuum cooling, scrubber stores, rapid heat removal, cool storage, ethylene reduction systems and modified atmosphere storage.
It is important to identify the storage method and to provide details on how storage method improves shelf life/marketability of crops. Candidates who reviewed the storage and transportation of named crops did gain higher marks.
Many candidate answers were very general in response to the question. To gain higher marks, it is required to provide specific detail which relates to named crops.

Section D. Structured Questions (Plant Health).

*Q5. a) Describe the symptoms of damage and the life cycle of **TWO NAMED** plant parasitic nematodes (eelworms)*

*b) Explain how to prevent and control infestations of the **TWO** plant parasitic nematodes (eelworms) referred to in (a).*

Most candidates were able to name two plant parasitic nematodes, but only went on to describe the symptoms and life-cycle of one, which may be because they did not read and understand the question! Candidates gained highest marks described the life-cycle from egg to adult and identified how some species of nematodes adapt to survive outside of its food source. They were also able to state which part of the plant the eelworm infested and gave full description of symptoms of infestation to parts of the plant above ground and within the plant tissues.

In part (b) some candidates gave excellent accounts of controlling eelworms, including accurately describing where applicable, heat treatments, cultural controls, purchasing of clean stock and chemical controls.

Q6. a) Describe the effects of the Plant Protection Products Directive (European Council Directive 91/414/EEC) and its impact on the use of plant pesticides within the EU.

b) In accordance with the Control of Pesticides legislation of 1986, describe the requirements of a storage facility, used to hold small quantities of pesticides.

a) Candidates were able to highlight how pesticides impact on the environment and described alternative systems and methods of controlling pests. However, the main body of this question required candidates to demonstrate their knowledge of the European Council Directive Review; candidates who were able to explain the need to harmonise the use of pesticides, to ensure they met modern safety standards and highlighted with examples of how the Review had reduced the range of pesticides available gained highest marks.

b) The requirements of a storage facility for pesticides was generally well-understood

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