



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 **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 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 B

**Plant Taxonomy, Morphology & Anatomy
Plant Physiology
Plant Health**

Section A – Short Answer Questions

Please turn over/.....

ANSWER ALL QUESTIONS

Marks

Q1 Explain the meaning of the following specific epithets:

- i) *Calendula officinalis*;
- ii) *Primula bulleyana*;
- iii) *Thuja occidentalis*;
- iv) *Wisteria sinensis*.

2

.....

.....

.....

.....

.....

Q2 Describe how the androecium differs in wind and insect pollinated plants, naming **ONE** plant example in **EACH** group.

2

.....

.....

.....

.....

.....

Q3 Explain the function for **EACH** of the following in relation to plant structure:

- i) cytoplasm;
- ii) plasmodesmata.

2

.....

.....

.....

.....

.....

Please see over/.....

ANSWER ALL QUESTIONS

Marks

Q4 Describe the stem adaptations and functions of **EACH** the following:

- i) *Solanum tuberosum* – Potato;
- ii) *Parthenocissus tricuspidata* – Boston ivy;
- iii) *Ruscus aculeatus* – Butcher’s broom;
- iv) *Berberis stenophylla* – Barberry.

2

.....

.....

.....

.....

.....

Q5 State the mode of action of the active ingredient in **EACH** of the following pesticides:

- i) simazine;
- ii) methiocarb;
- iii) imidacloprid;
- iv) bifenthrin.

2

.....

.....

.....

.....

Q6 a) State the difference between complete and incomplete metamorphosis in insect pests.

b) Name **ONE** pest example of horticultural significance for **EACH** group.

2

.....

.....

.....

.....

.....

Please turn over/.....

ANSWER ALL QUESTIONS

Marks

Q7 State **TWO** causes of 'blossom end rot' in tomatoes and **TWO** methods of control.

2

.....

.....

.....

.....

.....

Q8 Explain the essential interaction between growing conditions and physiological requirements to ensure the successful rooting of leafy cuttings.

2

.....

.....

.....

.....

.....

Q9 Explain the effects of greenhouse ventilation on the rates for **EACH** of the following plant physiological processes:

- i) photosynthesis;
- ii) transpiration.

2

.....

.....

.....

.....

.....

Please see over/.....

ANSWER ALL QUESTIONS

Q10

- a) Define the term 'plant tropism'.
- b) Name **TWO** plants exhibiting a thigmotropic response.

Marks

2

.....

.....

.....

.....

.....



**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 **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 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 B

**Plant Taxonomy, Morphology & Anatomy
Plant Physiology
Plant Health**

Sections B, C & D

Structured Questions

Please turn over/.....

Section B – Plant Taxonomy, Morphology & Anatomy

Answer ONE question only from this section

	Marks
Q1 a) Compare and contrast the structure of the monocotyledonous flower with a dicotyledonous flower with the aid of large, clearly labelled diagrams.	8
b) Describe the function of the perianth whorls in both types of flower shown in a).	5
c) Describe the function of the androecium and gynaecium in the growth development of the plant.	7
Q2 a) Describe FOUR morphological modifications of the stem and leaves of plants that can be utilised for vegetative propagation. Use diagrams and NAMED examples to illustrate your answer.	12
b) Describe the process of root formation at the base of a stem cutting from the time at which it is separated from the stock plant.	8

Please see over/.....

Section C - Plant Physiology

Answer ONE question only from this section

		Marks
Q3	a) Describe the role of water in the plant.	6
	b) Describe how water and solutes enter the plant root with the aid of a large clearly labelled diagram.	8
	c) Explain how the properties of the semi-permeable membrane, affects the absorption of water and solutes.	6
Q4	a) Explain how aerobic respiration differs from anaerobic respiration.	10
	b) Explain how the relationship between photosynthesis and respiration can be used to advantage by the grower.	10

Please turn over/.....

Section D – Plant Health

Answer **ONE** question only from this section

	Marks
Q5 Describe the symptoms of EITHER apple powdery mildew OR rose powdery mildew and explain how it is most effectively prevented and controlled.	20
Q6 a) Name a different herbicide (active ingredient) for EACH of the situations listed below. In EACH instance, state the time of year and stage of weed growth when herbicide application would be most effective:	
i) Maintaining a weed free rose border in a public park;	5
ii) Controlling broad leaf weeds actively growing in a municipal bowling green;	5
iii) Clearing woody weeds from a piece of derelict land.	5
b) Describe the assessments required in order to satisfy Health and Safety regulations for the protection of people and the environment when applying herbicides in public places.	5



RHS (LEVEL 3) ADVANCED CERTIFICATE IN HORTICULTURE WRITTEN EXAMINATION

Tuesday 4th July 2006

Module B

Plant Taxonomy, Morphology & Anatomy Plant Physiology Plant Health

Examiners Report

Candidates Registered	338		Total Candidates Passed		
Candidates Entered	258	76.33%	Passed with Commendation	7	2.71%
Candidates Absent	59	17.46%	Passed	117	45.35%
Candidates Deferred	10	2.96%	Failed	134	51.94%
Candidates Withdrawn	11	3.25%			

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 Explain the meaning of the following specific epithets:

- v) *Calendula officinalis*;
- vi) *Primula bulleyana*;
- vii) *Thuja occidentalis*;
- viii) *Wisteria sinensis*.

Few candidates gained full marks for this question reflecting a weakness in candidates' knowledge of the meaning of plant names. A number of candidates failed to understand to which part of the plant name the 'specific epithet' referred. Most candidates correctly linked occidentalis with the America's and coming from the West and sinensis meaning from China or the Far East. Only a relatively low number of candidates were able to link officinalis with the official plant of the old herbalists carrying benefits of a pharmaceutical or medical nature; and bulleyana as being commemorative of A.K. Bulley who established Ness Gardens and Bee's Seed Company, apart from his sponsorship of several plant hunting expeditions.

Q2 Describe how the androecium differs in wind and insect pollinated plants, naming **ONE** plant example in **EACH** group.

Most candidates were awarded marks for this question, but few gained full marks. Candidates were generally aware of the main differences in the androecium between wind and insect pollinated plants, but failed to make the difference sufficiently clear in their answers; a number confused the androecium with parts of the gynaecium or confused pollen with seeds. Candidates in the main gained marks for correctly naming plant examples belonging to each pollination group; unfortunately some candidates confused the groups by naming plant examples as wind pollinated when in fact it was the seed dispersal mechanism which was windblown.

Q3 Explain the function for **EACH** of the following in relation to plant structure:

- i) cytoplasm;
- ii) plasmodesmata.

Almost all candidates were able to give full and adequate answers to this two-part question. The answers reflected good teaching and learning in both anatomical and physiological botany, with candidates frequently awarded full marks.

Q4 Describe the stem adaptations and functions of **EACH** the following:

- i) *Solanum tuberosum* – Potato;
- ii) *Parthenocissus tricuspidata* – Boston ivy;
- iii) *Ruscus aculeatus* – Butcher's broom;
- iv) *Berberis stenophylla* – Barberry.

Again most candidates were awarded marks for this question, but few were able to gain full marks due to weaknesses in their knowledge of the range of stem adaptations presented. Candidates were required to describe or identify the stem adaptation involved and also the function of purpose of each. Marks could not be awarded when one or both of these

requirements were omitted; in particular many candidates failed to refer to the adhesive (sticky) pads of *Parthenocissus tricuspidata* and the flattened stems with photosynthetic (leaf) capabilities of *Ruscus aculeatus*.

Q5 State the mode of action of the active ingredient in **EACH** of the following pesticides:

- iv) *simazine*;
- v) *methiocarb*;
- vi) *imidacloprid*;
- vii) *bifenthrin*.

Only a few candidates were awarded full marks for this four-part question, where most either gained very low or no marks at all. The answers were very disappointing and reflected scant or no knowledge of this subject (syllabus) area. Teaching and learning in the whole area of crop protection relative to plant health, needs to be addressed with a similar level of importance as other subject areas; ensuring adequate coverage is given to the cultural biological and pesticide options of control. The question referred to four very common and widely used pesticides with which candidates should be familiar and required their modes of action as: Simazine – residual herbicide; Methiocarb – stomach poison; Imidacloprid – systemic/stomach poison; Bifenthrin – contact insecticide.

Q6 a) State the difference between complete and incomplete metamorphosis in insect pests.
b) Name **ONE** pest example of horticultural significance for **EACH** group.

Very few candidates were awarded full marks for this question as many frequently confused some of the stages of the four-stage process of complete metamorphosis. Part (a) simply required candidates to state and name the four and three stages associated with complete and incomplete metamorphosis respectively. Part (b) was answered more accurately by candidates than part (a) but marks were not awarded when examples given did not identify pests of horticultural significance. It was insufficient to name examples as caterpillars or butterflies when fuller and more accurate descriptions were required eg cabbage white butterfly or whiteflies.

Q7 State **TWO** causes of 'blossom end rot' in tomatoes and **TWO** methods of control.

Answers to this question indicated good teaching and learning with most answered identifying uneven water supply and calcium deficiency as the two primary causes of blossom end rot. Weaknesses were identified in methods of control particularly when candidates gave vague answers such as "apply a general feed", when specific reference to sources of calcium was needed. The examiner awarded marks to candidates who identified other factors which could be associated with this problem such as excess humidity, high levels of ammoniacal nitrogen, and insufficient transpiration and how to counteract each one.

Q8 *Explain the essential interaction between growing conditions and physiological requirements to ensure the successful rooting of leafy cuttings.*

The question required candidates to identify the essential environmental factors needed to successfully root leafy cuttings and to explain how each of these interacts to meet the physiological requirements of the cuttings. Candidates, frequently, were aware of the growing conditions or factors required for success, but many failed to explain the “interactions” which occur to meet the physiological or growth development requirements of the leafy cuttings e.g. controlling the sun/shade conditions to the physiological benefit of the cuttings; the shade reduces leaf temperature and water stress to maintain turgidity whilst exposure to sunlight will ensure photosynthesis continues to provide energy for root initials to develop. Other essential interaction would include humidity/ventilation and transpiration; temperature effects on root and top (shoot/leaf) growth; the interaction between compost environment and the cuttings need for moisture, drainage and oxygen etc. Marks were awarded to those who explained the interaction between rooting “hormones” and the cuttings ability to produce roots more quickly.

Q9 *Explain the effects of greenhouse ventilation on the rates for **EACH** of the following plant physiological processes:*

- iii) *photosynthesis;*
- iv) *transpiration.*

Answers to this question indicated that candidates had not read and fully understood the question set. Consequently marks were not awarded when the key elements of the question were not answered. The question asked candidates to explain the effects of greenhouse ventilation on the rates of photosynthesis and transpiration. In short, would the rates go up or down depending on if the ventilators were open or closed etc. The most frequent problem with candidates’ answers was the absence of any reference as to how the “rates” would be affected and this resulted in marks not being awarded. Answers referring to photosynthesis formulae, respiration and unrelated or confused answers did not attract marks. Those who gained marks referred to the “effect on the rates” of photosynthesis and transpiration with open and closed ventilation options and related “the rates” to other impinging factors, such as a rise or fall in temperature. Candidates should address the key elements of the question and in this case it was the effect of greenhouse ventilation on the rates of photosynthesis and transpiration.

Q10 a) *Define the term ‘plant tropism’.*
 b) *Name **TWO** plants exhibiting a thigmotropic response.*

Full and comprehensive answers to this question were a common feature with candidates in the main gaining maximum marks. In part (a) very good definitions of the term “plant tropism” were given and included references to a plant’s response to an external stimulus acting from a particular direction and producing a bending movement. Other references such as a plant turning toward a stimulus, or differential rates of growth and the accumulation of auxins controlling the growth response, all attracted marks. Similarly, in part (b) most candidates were able to name two plants showing thigmotropic responses including Clematis sp, Lonicera sp, Wisteria sp, Lathyrus sp. etc. Relatively few candidates did not understand what thigmotropic response meant.

Section B – Plant Taxonomy, Morphology & Anatomy

- Q1**
- a) *Compare and contrast the structure of the monocotyledonous flower with a dicotyledonous flower with the aid of large, clearly labelled diagrams.*
 - b) *Describe the function of the perianth whorls in both types of flower shown in a).*
 - c) *Describe the function of the androecium and gynaecium in the growth development of the plant.*

The first part of this question asked for comparisons (with the aid of diagrams) of monocotyledonous and dicotyledonous flowers. There were some very good diagrams given particularly of the dicotyledonous flower. Choosing a grass flower for the comparison is not ideal since it is so specialized and led later in the question to statements that “monocotyledonous flowers all have reduced perianth because they are wind pollinated”. Both diagrams should have been labelled fully so that it was clear which structures they had in common. In only a minority of answers was it stated that dicotyledonous flowers have sepals and petals while the majority of monocotyledonous flowers have two whorls that are alike in morphology called tepals.

Those candidates who understood about sepals, petals and tepals answered the second part of the question very well. Almost everybody knew that petals attract pollinators, fewer knew that sepals protect the flower in bud while very few knew that tepals serve both functions. Although the possibility that someone would refer to some sepals acting in attracting pollinators and some petals are formed into nectaries (both in Helleborus) was allowed for in the mark scheme, nobody did in fact make any reference to this.

In general, the third part of the question on the function of the androecium and gynaecium in the life-cycle of the plant was answered quite well. Although almost everybody located pollen in the anthers, not many actually stated that the anthers produced the pollen. The role of the stigma was well understood. Many candidates were aware also that the filament and style positioned the anther and stigma so that they could contact pollinators. Some confusion however was apparent when referring to the ovules. Sometimes these were referred to as ova or embryo sac or even other parts of the ovular apparatus. Few therefore, managed to state that the ovary contained ovules or that the ovule became the seed after fertilisation. Although several attempted to describe the full sequence of events in double fertilisation, that level of detail was not required by the question.

- Q2** a) Describe **FOUR** morphological modifications of the stem and leaves of plants that can be utilised for vegetative propagation. Use diagrams and **NAMED** examples to illustrate your answer.
- b) Describe the process of root formation at the base of a stem cutting from the time at which it is separated from the stock plant.

Many very good answers were received to the first part of this question. When the modification chosen was a runner, a stolon, a stem tuber or a rhizome, candidates generally understood the structure concerned and provided meaningful diagrams. Most, however, did not draw the potato stolons correctly as coming from the stem nor did they show the individual potato tuber as having a rose end. There were many other possibilities e.g. bulb embryos on leaves, as long as the reference was to a morphological modification. Some students misread the question and just provided four examples of vegetative propagation e.g. Begonia rex leaf slashing, Streptocarpus leaf lamina cuttings, hardwood cuttings, grafting etc for which it was not possible to award marks.

The second part of the question concerning the rooting of cuttings was very well answered by candidates, many mentioning callus formation, meristematic tissue, division of the cambium, auxin and root initials. However, these were not always linked up in a logical manner. The points were usually missed were wound sealed with suberin, auxin is produced by young leaves as well as the stem apex and in some plants roots initials are already present e.g. Solenostomon. Some confusion was apparent over the origin of the roots, several answers relating their origin to the pericycle and then subsequently went on to describe the development of secondary roots.

Section C - Plant Physiology

- Q3**
- a) *Describe the role of water in the plant.*
 - b) *Describe how water and solutes enter the plant root with the aid of a large clearly labelled diagram.*
 - c) *Explain how the properties of the semi-permeable membrane, affects the absorption of water and solutes.*
- a) The majority of candidates gained good marks for this part of the question. Higher marks were awarded to candidates who recorded at least five roles which included nutrient transport and the storage of unwanted substances.
- b) Candidates who provided clear labelled sketches which assisted the answer were awarded high marks. Correct and modern information on how water and solutes enter the Plant root which should contain detail of osmosis, diffusion, passive and active nutrient absorption was required.
Candidates failed to gain optimum marks for two main reasons:
I. Poor quality diagrams which were often very small
II. Lack of technical detail especially with solute entry into the plant
- c) Candidates who explained how the properties of the semi permeable membrane affected the absorption of water and solutes gained higher marks. The majority of candidates lost time by providing details which were not required i.e. irrigation methods.
- Q4**
- a) *Explain how aerobic respiration differs from anaerobic respiration.*
 - b) *Explain how the relationship between photosynthesis and respiration can be used to advantage by the grower.*
- a) Very good answers by the majority of candidates. Candidates who fully explained how glycolysis relates to aerobic and anaerobic respiration gained high marks.
- b) Candidates who provided technical answers were awarded higher marks i.e. light should be recorded in respect of intensity, quality and duration.
The importance of leaf area index was missing from the majority of candidate answers. Answers should have recorded that Photosynthesis is a Synthesizing process and respiration is a degrading reaction/

Section D – Plant Health

- Q5** Describe the symptoms of **EITHER** apple powdery mildew **OR** rose powdery mildew and explain how it is most effectively prevented and controlled.

All candidates easily described the general characteristics of powdery mildew on apples or roses. Higher marks were given to those who understood the disease's life cycle and were able to describe its progression from a primary infection through to over-wintering stage. A number of candidates gave full accounts of methods of controlling mildew, including workable cultural techniques, choice of varieties and chemical spray options.

- Q6** a) Name a different herbicide (active ingredient) for **EACH** of the situations listed below. In **EACH** instance, state the time of year and stage of weed growth when herbicide application would be most effective:
- i) Maintaining a weed free rose border in a public park;
 - ii) Controlling broad leaf weeds actively growing in a municipal bowling green;
 - iii) Clearing woody weeds from a piece of derelict land.
- b) Describe the assessments required in order to satisfy Health and Safety regulations for the protection of people and the environment when applying herbicides in public places.

Candidates were able to name an herbicide for the situation described, some being more appropriate than others. Stages of weed development and timing would be paramount for success, and therefore higher marks were awarded where this was accurately described. Many candidates wrote about the legislation surrounding pesticide application, whilst what was required was a working list of assessments, which would be implemented when applying herbicides in areas accessible by the general public.