



Candidate Number: .....

Candidate Name: .....

Centre Number/Name: .....

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

**Tuesday 8 February 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.**

**Mark  
s**

**Q1** State the meaning of the specific epithet in each of the following plant names:

- i) *Pyrus salicifolia*;
- ii) *Wisteria sinensis*;
- iii) *Erica carnea*;
- iv) *Pseudotsuga menziesii*.

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**Q2** Explain the function for **EACH** of the following plant cell parts:

- i) Vacuole;
- ii) Tonoplast and Plasmalemma membranes.

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**Q3** a) Describe the differences between the following types of inflorescence:

- i) actinomorphic flowers;
- ii) zygomorphic flowers.

b) Name **ONE** example for each type of inflorescence in part (a).

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Please see over/.....

**Answer All questions**

**Marks**  
**2**

**Q4** Name **TWO** physiological activities which enable the roots and shoots of plants to develop.

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**Q5** State the function of **EACH** of the following:

- i) palisade mesophyll;
- ii) spongy mesophyll.

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**Q6** State the difference between a 'botanical fruit' and a 'false fruit'. Name **ONE** example of **EACH**.

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**Q7** State **FOUR** uses of water in plants.

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Please turn over/.....

**Answer All questions**

**Marks**

- Q8** a) Describe the symptoms of oedema in plants.  
b) State the cause of oedema and name **ONE** plant commonly affected.

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- Q9** Name **ONE** herbicide active ingredient for each of the following groups of herbicides.

- i) **contact;**
- ii) **translocated;**
- iii) **selective;**
- iv) **total.**

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- Q10** State the effects of 'water potential' in relation to each of the following:

- i) **osmosis;**
- ii) **plasmolysis.**

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

**Tuesday 8 February 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.**

	<b>Marks</b>
<b>Q1</b> a) Describe the structure of a <b>NAMED</b> bulb with the aid of large clearly labelled diagrams.	<b>6</b>
b) Describe how the structure of corms and tubers differ from that of bulbs, using <b>NAMED</b> examples.	<b>8</b>
c) State how the different structure of bulb, corms and tubers determines the possibilities of propagation.	<b>6</b>
<b>Q2</b> a) Describe the structure and function of EACH of the following cells and tissues within the stem of a dicotyledous plant:  i) collenchyma; ii) sclerenchyma; iii) phloem; iv) xylem.	    <b>12</b>
b) Describe how the structure changes as a result of secondary thickening in woody stems.	<b>8</b>

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**Please see over/.....**

## Section C - Plant Physiology

Answer ONE question from this section.

	<b>Mark s</b>
<b>Q3</b> Explain the physiological processes responsible for <b>EACH</b> of the following conditions/responses:	
a) oedema;	<b>5</b>
b) a plant placed on a window sill grows towards the light;	<b>5</b>
c) the death of a plant in a water-logged soil;	<b>5</b>
d) an increase in plant growth resulting from burning propane gas in a greenhouse.	<b>5</b>
<b>Q4</b> a) Describe the process of photosynthesis and explain how limiting factors affect its efficiency in plant growth.	<b>10</b>
b) Describe how carbohydrates produced by photosynthesis are:	
i) translocated;	<b>5</b>
ii) utilized.	<b>5</b>

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**Please turn over/.....**

## Section D – Plant Health

Answer ONE question from this section.

		<b>Marks</b>
Q5	a) List <b>FOUR</b> important invertebrate pest of <b>EITHER</b> top fruit or soft fruit.	<b>4</b>
	b) Describe the symptoms and damage caused by <b>TWO</b> of the pests listed in (a) and describe a control strategy for <b>EACH</b> .	<b>16</b>
Q6	a) Name <b>TWO</b> distinct weed species to be found in <b>EACH</b> of the following situations:  i) established amenity turf; ii) a vegetable garden; iii) container grown trees and shrubs; iv) a non-cropping situation.	<b>8</b>
	b) Name an appropriate chemical herbicide (active ingredient) to control one of the weeds named in each situation.	<b>4</b>
	c) Describe a programme of cultural operations which could be adopted in order to prevent weed establishment in each of the situations listed in (a).	<b>8</b>

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## RHS (LEVEL 3) ADVANCED CERTIFICATE IN HORTICULTURE

Tuesday 8<sup>th</sup> February 2005

### MODULE B

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

#### Examiners Comments

Candidates Registered	278	Total Candidates Passed		
Candidates Entered	214 (77.0%)	Passed with Commendation	28	(13.1%)
Candidates Absent	45 (16.2%)	Passed	107	(50.0%)
Candidates Deferred	13 (4.7%)	Failed	79	(36.9%)
Candidates Withdrawn	6 (2.1%)			

#### Senior Examiners Comments.

In the scripts marked from the four modules (A, B, D & E) of the February 2005 Advanced Certificate in Horticulture examinations, there were often too many generalisations. With many answers there was a lack of clear factual information backed up by appropriate horticultural and technically correct examples. It is essential that candidates are briefed in the importance of providing factual information, appropriate and accurate examples to demonstrate their application and understanding of the questions.

Candidates should:

- ∞ Obtain instruction in basic examination techniques, i.e. **read questions carefully and answer the question as set**, allowing sufficient time for each part of the question and ensuring that all sections of a question are answered;
- ∞ Acquaint themselves with examination terminology and its meaning; for example the differences between state, describe, explain, evaluate, etc.

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

**Describe - to give a descriptive account of**

**Explain - to make the meaning clear –it requires more information than a description, invariably based on an understanding of the underlying principles.**

**List - to itemise**

**Evaluate - to review the best points and problem areas**

- ∞ Practise interpreting examination questions;
- ∞ Undertake mock examinations (time constrained) and seek constructive feedback;
- ∞ Understand vocational terminology;
- ∞ Use large, clearly labelled diagrams where it is helpful to do so but do not waste time by giving annotated diagrams and then repeating the information in text form, the use of colour should only be used where it enhances the interpretation of the diagram.
- ∞ Give the full name to an item when it is first stated and avoid the use of quick lecture shorthand e.g. –ve for negative & +ve for positive.
- ∞ Demonstrate full understanding of a subject by relating answers to named examples and or principles, whether or not requested in the question.
- ∞ Present the answer in the order required by the question or clearly mark the answer with the appropriate question sections;
- ∞ **When naming plants use full botanical names, i.e. genus and specific epithet.**

Examination paper markers commented that it was difficult to mark some of the exam scripts because candidates failed to properly identify the question. There were many instances of poor handwriting and the way in which the answer was laid out exacerbated this problem. If an examiner cannot read the candidate's writing it is not possible to award marks. Candidates need to identify their answers by clearly writing the question and section numbers.

## Section A. Short Answer Questions

Q1. State the meaning of the specific epithet in **EACH** of the following plant names:

- i) *Pyrus salicifolia*;
- ii) *Wisteria sinensis*;
- iii) *Erica carnea*;
- iv) *Pseudotsuga menziesii*.

Many candidates demonstrated a sound knowledge of these specific epithets and gained full marks for accuracy in each part. Too many candidates incorrectly referred to the specific epithet (*Erica*) *carnea* as meaning "of the heath land" rather than correctly as meaning pink or flesh coloured and subsequently marks were not awarded. Most candidates correctly interpreted the specific epithet (*Pseudotsuga*) *menziesii* as referring to the person who in this case first discovered the plant rather than the person who introduced it. Although answers to this question were generally good, a significant number of candidates showed a lack of knowledge in this subject area.

Q2. Explain the function for **EACH** of the following plant cell parts:

- i) Vacuole;
- ii) Tonoplast and Plasmalemma membranes.

Candidates demonstrated sound knowledge of the functions associated with the plant cell's vacuole thus gaining the appropriate marks. Unfortunately fewer candidates were able to show a similar knowledge of the functions associated with the tonoplast and the plasmalemma membranes. Although a good number of candidates were able to correctly identify the Tonoplast as the inner membrane separating the vacuole and the cytoplasm, a significant number failed to gain marks by not stating that the plasmalemma membrane is the outer membrane separating the cytoplasm from the cell wall and that both membranes are in fact differentially semi-permeable.

Q3. a) Describe the differences between the following types of inflorescence.

- i) actinomorphic flowers;
- ii) zygomorphic flowers.

b) Name **ONE** example for **EACH** type of inflorescence in part a).

Many candidates who were unfamiliar with these two types of inflorescences answered this question inadequately. Too many answers confused this terminology with monocious and dioecious flowers and thus gave incorrect answers. Marks were given to those who described Actinomorphic flowers as being radially symmetrical in any direction and Zygomorphic flowers as being bilaterally symmetrical into two identical parts. Additionally providing full botanical names for suitable examples appropriate to each flower type secured full marks for this question.

Q4. Name **TWO** physiological activities which enable the roots and shoots of plants to develop.

Candidates generally received high marks for this question after clearly demonstrating a good knowledge of the physiological activities enabling the roots and shoots of plants to grow. Most were able to refer to the processes of mitotic cell division in apical meristems, vacuolar expansion of cells and energy supplied by the processes of photosynthesis and respiration. References to tropisms also gained marks in this question.

Q5. State the function of **EACH** of the following:

- i) palisade mesophyll;
- ii) spongy mesophyll.

Consistently good answers to this question reflected sound teaching. Most candidates gained full marks for adequately descriptive answers to both parts of the question. High marks were awarded to those who stated that the function of the palisade tissue is to collect and allow light penetration and that it is the site where maximum photosynthetic activity takes place. For the spongy mesophyll marks were gained when candidates referred to loosely packed cells being designed for gaseous diffusion in air spaces and also in solution. Few recognised that some photosynthetic activity does take place in the spongy mesophyll.

Q6. State the difference between a 'botanical fruit' and a 'false fruit'. Name **ONE** example of **EACH**.

Too many candidates were unable to differentiate correctly between "botanical" and "false fruits" or named examples in the wrong grouping. Consequently either no marks were awarded or lower marks were given for partially correct answers.

Those gaining higher marks were able to state that botanical fruits are derived directly from fertilised ovaries and their contents as in tomato and plum whilst false fruits are derived from another part of the flower e.g. the receptacle which swells up to envelope the ovary, as in apple, or forms a swollen mound on which the true hardened fruits containing seeds are set, as typically seen in strawberries.

Q7. State **FOUR** uses of water in plants.

Good teaching and learning was evident in the full and complete answers provided by most candidates in answer to this question. In consequence, almost all candidates were awarded full marks. Candidates were able to state that water is: -

Used to cool plants in transpiration, act as a solution for mineral nutrient uptake and transfer, is a solution for sugar/glucose transport within plants: is used in the process of photosynthesis: gives plant their turgidity and distributes gasses (CO<sub>2</sub> and O<sub>2</sub>) in solution.

Q8. a) Describe the symptoms of oedema in plants.

b) State the cause of oedema and **NAME ONE** plant commonly affected.

Candidates gave very knowledgeable answers (with an example) to this question in general and only a few failed to gain marks due to weak or patchy knowledge. Generally candidates described the symptoms correctly as leaf or stem tissue swellings initially greenish/yellow but turning brownish in colour later. The cause of oedema was well understood as being due to excessive amount of water in plant cells. However, full marks were not always awarded when candidates failed to mention over watering of plants, high atmospheric humidity and inadequate ventilation as contributing causes.

Q9. Name **ONE** herbicide active ingredient for **EACH** of the following groups of herbicides.

- i) *contact;*
- ii) *translocated;*
- iii) *selective;*
- iv) *total.*

This question was poorly answered by many candidates, with only a few giving complete and accurate answers, to gain maximum marks. Candidates frequently confused translocated with selective herbicides and vice-versa. Also some candidates failed to recognise that certain translocated herbicides e.g. glyphosate can also be quoted as a total herbicide when used for that specific purpose. Marks were not awarded for popular or trade names when the question specified active ingredient. Full marks were awarded only to those who quoted accurate active ingredients for each part e.g. contact; - paraquat: translocated; - glyphosate: selective: - 2-4D; total: - sodium chlorate. The varied and inadequate answers to this question indicate inadequate syllabus coverage or revision.

Q10. State the effects of 'water potential' in relation to **EACH** of the following:

- i) *osmosis;*
- ii) *plasmolysis.*

The effects of "water potential" relative to osmosis were well understood generally. Those gaining higher marks were able to state that the effects of "water potential" is to move mineral nutrients (few solutes) from a region of high water potential (in the soil) to a region of low water potential (within the cell vacuole) with a high level of solutes in it. Candidates gaining marks indicated the effects water potential and osmosis as being an increase in cell turgor pressure. Frequently marks were not awarded in the second part of the question because candidates did not understand the term plasmolysis and also because they did not recognise that this is due to osmosis and the effects of water potential working in reverse, also resulting in reduction in turgor pressure and plant structure wilting.

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

- Q1. a) Describe the structure of a **NAMED** bulb with the aid of large clearly labelled diagrams.
- b) Describe how the structure of corms and tubers differ from that of bulbs, using **NAMED** examples.
- c) State how the different structure of bulb, corms and tubers determines the possibilities of propagation.

This as an unpopular question only 28% of students attempting it.

There were some very good diagrams of a named bulb but very few students described the bulb and many diagrams were sketchy. Surprisingly few students equated the base plate with a modified stem, it was usually labelled one or the other. Almost no student described the food storage organs as leaf bases, most labelling them as leaves or scale leaves even though in the latter case their drawing was not an etunicate bulb. 'Daughter' bulbs were not in general equated with axillary buds. The latter caused problems when attempting to answer c). The structure of corms and tubers was not well known, nor was the range of type of tuber appreciated. Examples of corms could often be stated although a minority thought that Cyclamen and Begonia are example of corms. The structure of a corm was not well known either and there was some confusion with the structure of the bulb. Drawings were, in general, poor. Tuber types were restricted to stem tubers of potato and root tubers of Dahlia. The drawings of potato tuber were seldom good and there was very little appreciation that the 'eyes' were axillary buds subtended by scale leaves on a swollen stem. No student mentioned the stem/hypocotyls perennial tubers of Cyclamen and Begonia. Most candidates scored well on the propagation part of the question, although it was noticeable how few related the possibilities for propagation to the structure. This was most successful in the description of the process of twin-scaling bulbs.

However, most students had difficulty in stating that the lack of buds on root tubers would necessitate the retention of some portion of stem with bud. The propagation of corms was not known, some suggesting that cutting them in pieces each with bud would work. Confusion with perennial tubers was obvious here.

- Q2. a) Describe the structure and function of **EACH** of the following cells and tissues within the stem of a dicotyledonous plant:
- i) collenchyma;
  - ii) sclerenchyma;
  - iii) phloem
  - iv) xylem.
- b) Describe how the structure changes as a result of secondary thickening in woody stems.

Question 2 was answered by 72% of students and there were some very good responses.

The first part of the question required students to give an account of collenchyma sclerenchyma, phloem and xylem. Collenchyma was well understood as a strengthening tissue with flexibility for young/herbaceous stems. The description of the individual cells was not usually described as well, only a minority referred to thickening especially in the corners of cells and none referred to the thickening being of the secondary wall. A minority thought collenchyma was phloem or that it was lignified.

Sclerenchyma was also well understood as a strengthening tissue and occasionally mention was also made of its protective function in, for example, the endocarp of drupes. Relatively few students were aware that the cells varied in shape, fibres and sclereids, and descriptions/drawings of the difference were poor. A minority thought sclerenchyma conducted water.

Phloem was usually described well with some excellent drawings of sieve tubes and their accompanying companion cells. Several drawings, however, showed more than one companion cell per sieve tube element. Most responses also failed to mention that phloem also contains fibres and parenchyma. A majority of students understood phloem to conduct the products of photosynthesis but only a very small minority stated that the transport sugar is sucrose.

Xylem was usually well described although, again, fibres and parenchyma were usually omitted. The function of xylem was universally known.

There were some very good accounts of secondary thickening described in a logical, step-by-step manner. There was, however, much confusion. Phloem and xylem were placed the wrong way round, rings of secondary tissue were placed outside entire primary vascular bundles and the phloem was said to move to the outside of the stem and give rise to the cork etc. Diagrams were variable. There were some very clear, accurate, well-labelled diagrams of the early stages showing inter-fascicular cambium as well of the later stages showing annual rings and cork cambium and its derivatives. However, there were also many poor diagrams and some responses tried to describe the process without a single diagram. Good, clear diagrams are really essential in such a question as this.

## Section C. Structured Questions (Plant Physiology).

Q3. Explain the physiological processes responsible for **EACH** of the following conditions/responses:

- a) oedema;
- b) a plant on a window sill grows towards the light;
- c) the death of a plant in a water-logged soil;
- d) an increase in plant growth resulting from burning propane gas in a glasshouse.

Candidates who fully explained the physiological processes gained higher marks compared to many candidates who presented definitions of concepts only.

- a) In the case of oedema many candidates failed to record external environmental conditions, which stimulate the condition. Candidates who explained clearly the damage resulting from the condition gained higher marks.
- b) The role Auxin was clearly explained by the majority of candidates. Diagrams need to be large and labelled to be of assistance with this question.
- c) Candidates need to relate the lack of respiration at the roots with the photosynthesis, respiration and transpiration at the meristem/leaf areas. The problems resulting from anaerobic respiration were clearly explained by the majority of candidates.
- d) Candidates gained higher marks when explaining:
  - i. The increase in  $\text{CO}_2$ ;
  - ii. Timing of  $\text{CO}_2$  increase;
  - iii. Other factors to consider when increasing  $\text{CO}_2$ , i.e. light saturation point;
  - iv. The stage of the crop growth for  $\text{CO}_2$  increase, i.e. leaf area index.

Q4. a) Describe the process of photosynthesis and explain how limiting factors affect its efficiency in plant growth.

b) Describe how carbohydrates produced by photosynthesis are:

- i) translocated;
- ii) Utilized.

a) Candidates who presented clear information on the different stages of photosynthesis, i.e. light and dark stage, gained higher marks. The use of clearly labelled diagrams very much assisted the answers by the majority of candidates. The limiting factors were reviewed in detail by many candidates. Higher marks were awarded when the limiting factors were related to the photosynthetic rate and the resulting growth of the plant – this point was not answered by many candidates.



- b) Candidates who explained that carbohydrates are translocated by diffusion, cytoplasmic streaming, downward mass flow in the phloem, movement of dissolved salts in the xylem and movement via the vascular rays, gained higher marks. Many candidates provided general answers, which were lacking in botanical and technical detail.  
The majority of candidates provided clear information on how carbohydrates are utilized by the plants. Candidates who explained how ADP and ATP are of major importance in the utilization of energy gained higher marks.

## Section D. Structured Questions (Plant Health).

- Q5. a) List **FOUR** important invertebrate pests of **EITHER** top fruit **OR** soft fruit.
- b) Describe the symptoms and damage caused by **TWO** of the pests listed in a) and describe a control strategy for **EACH**.
- a) Candidates who achieve high marks were able to give full descriptive names of pests of top fruit and soft fruit. The least successful candidates listed pests of both top fruit and soft fruit, and used general pest names such as caterpillars, aphids.
- b) Candidates were required to describe fully the damage done by the pest, and should have included the period of the pest life cycle which was damaging. In order to set out a control strategy, knowledge of the pest's life cycle would be essential, and candidates need to describe cultural, biological and chemical control measures.
- Q6. a) Name **TWO** distinct weeds species to be found in **EACH** of the following situations:
- i) established amenity turf;
  - ii) a vegetable garden;
  - iii) container grown trees and shrubs;
  - iv) a non-cropping situation.
- b) Name an appropriate chemical herbicide (active ingredient) to control one of the weeds named in **EACH** situation.
- c) Describe a programme of cultural operations which could be adopted in order to prevent weed establishment in **EACH** of the situations listed in a).
- a) It was pleasing to see so many candidates gaining high marks by correctly identifying weeds by their correct botanical name.
- b) There appeared to be some limitation in candidates knowledge of herbicide selection, examples of herbicides no longer available or approved were frequently quoted.
- c) Candidates were expected to be able to give detailed information on cultural operations including timing in order to gain high marks.

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