Royal Horticultural Society

RHS LEVEL 3 DIPLOMA IN HORTICULTURE
WRITTEN EXAMINATION

Thursday 9 February 2012

2:00pm – 4:00pm

MODULE G

Genetics, Plant Breeding and Systematic Botany
Plant Physiology II

Section A – Short Answer Questions

Candidate Number:……

Candidate Name:……

Centre Number/Name:……

IMPORTANT – Please read carefully before commencing.

i) The duration of the papers in Module **G** 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.
vii) Please note, sufficient lined space is provided. It is not necessary that all lined space is used in answering the questions.

Please turn over/…..

ANSWER ALL QUESTIONS

MARKS

Q1 Describe the environmental conditions required for long term storage of plant produce. **2**

.....

.....

.....

.....

.....

Q2 State **FOUR** effects of gibberellins in the plant. **2**

.....

.....

.....

.....

.....

Q3 Explain what is meant by a 'day neutral plant' giving **ONE NAMED** example. **2**

.....

.....

.....

.....

.....

Q4 a) State what is meant by the term 'sterility' in plants. **1**

.....

.....

.....

b) State **ONE** example of its use in plant breeding. **1**

.....

.....

.....

Please see over/.....

MARKS

Q5 List **FOUR** sources of genetic variation in plants. **2**

.....

.....

.....

.....

.....

Q6 State the value of herbaria to horticulture. **2**

.....

.....

.....

.....

.....

Q7 State what is meant by genetic drift in the context of GM crops. **2**

.....

.....

.....

.....

.....

Q8 List **FOUR** pre-harvest conditions that will ensure maximum shelf-life of crops. **2**

.....

.....

.....

.....

.....

MARKS

Q9 Compare the energy yield of anaerobic and aerobic respiration in plants. **2**

.....

.....

.....

.....

.....

Q10 Identify the **TWO** areas of the light spectrum that are most effective for photosynthesis. **2**

.....

.....

.....

.....

.....

****

Royal Horticultural Society

RHS LEVEL 3 DIPLOMA IN HORTICULTURE
WRITTEN EXAMINATION

Thursday 9 February 2012

2:00pm – 4:00pm

MODULE G

Genetics, Plant Breeding and Systematic Botany
Plant Physiology II

Sections B and C - Structured Questions

IMPORTANT – Please read carefully before commencing.

i) The duration of the papers in Module **G** 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.
vii) Please note, sufficient lined space is provided in the answer booklets. It is not necessary that all lined space is used in answering the questions.

Please turn over/…..

Section B – Genetics, Plant Breeding and Systematic Botany

Answer ONE question only from this section

MARKS

Q11 a) Draw a labelled diagram to show the characteristic flower structure of a **NAMED** plant family. **8**

b) Describe the botanical characteristics of the family **NAMED** in a). **6**

c) Describe the horticultural value of **FOUR** genera from the family **NAMED** in a). **6**

Q12 a) Describe, with the aid of diagrams, the process of meiosis. **10**

b) State how the process of mitosis differs from meiosis. **6**

c) State the role of mitosis and meiosis in the plant. **4**

****

Please see over/.....

Section C – Plant Physiology II

Answer TWO questions from this section

MARKS

Q13 a) Explain why monoculture is normally adopted in horticultural crop production. **4**

b) Explain why weeds are usually excluded from monocultures. **4**

c) Explain how spacing in different crops can be manipulated to maximise yields. **12**

Q14 a) Explain the action of:

i) abscisic acid in moderating water stress; **4**
ii) ethylene in fruit ripening. **4**

b) Describe the use of **NAMED** synthetic growth regulators in horticulture. **12**

Q15 a) Define ‘juvenility’ in plants. **2**

b) Explain how ‘juvenility’ is manipulated in horticultural practice. **6**

c) Describe the processes involved in the transition to the adult stage. **12**

Q16 a) Describe the effects of temperature on plants. **12**

b) Describe how temperature can be manipulated to optimise plant growth and development. **8**

****

Royal Horticultural Society

RHS LEVEL 3 DIPLOMA IN HORTICULTURE
WRITTEN EXAMINATION

2:00pm Thursday 9 February 2012

MODULE G

Genetics, Plant Breeding & Systematic Botany
Plant Physiology II

Candidates Registered	**27**		**Total Candidates Passed**	**23**	**95.83%**
Candidates Entered	24	88.89%	Passed with Commendation	8	33.33%
Candidates Absent	2	7.41%	Passed	15	62.5%
Candidates Deferred	-	-	Failed	1	4.17%
Candidates Withdrawn	1	3.70%			

Section A – Short Answer Questions

Q1 Describe the environmental conditions required for long term storage of plant produce.

Most candidates produced very general answers. The levels of oxygen and carbon dioxide should have been stated. Answers should also have mentioned relative humidity and ethylene reduction.

Q2 State **FOUR** effects of gibberellins in the plant.

Most candidates produced good, clear answers which demonstrated a good understanding of this topic. Some candidates confused the role of auxins with that of gibberellins.

Q3 Explain what is meant by a ‘day neutral plant’ giving **ONE NAMED** example.

Most candidates produced a very good explanation of what is meant by ‘day neutral plants’ and included good plant examples.

Q4 State what is meant by the term ‘sterility’ in plants.

Many candidates explained why sterility was important in horticulture but this was not requested in the question. There were some candidates who referred to GM production, but this was also not required.

Q5 List **FOUR** sources of genetic variation in plants.

The majority of candidates produced good, clear answers to this question.

Q6 State the value of herbaria to horticulture.

There were many excellent answers to this question which clearly showed that the majority of candidates had a very good understanding of this topic.

Q7 State what is meant by genetic drift in the context of GM crops.

On the whole, this was poorly explained, with some very general answers being produced. The answer should have included information on the frequency of gene variation within a crop grown in organised batches.

Q8 List **FOUR** pre-harvest conditions that will ensure maximum shelf-life of crops.

Very few candidates included the following in their answer;

a) avoiding plant stress by maintaining nutrient levels during production time,
b) avoiding very low or high temperatures over a short period after harvesting.

Q9 Compare the energy yield of anaerobic and aerobic respiration in plants.

The majority of candidates provided excellent answers, with the ATP yields of the two processes correctly stated. Some candidates provided weak answers of a very general nature e.g. ‘anaerobic respiration is not good for plants’ and ‘anaerobic respiration provides less energy’.

Q10 Identify the **TWO** areas of the light spectrum that are most effective for photosynthesis.

The majority of candidates provided good answers although the blue wavelength of light at 430nm was not always included.

Sections B & C – Structured Questions

Section B - Genetics, Plant Breeding & Systematic Botany

Q11 a) Draw a labelled diagram to show the characteristic flower structure of a **NAMED** plant family.

b) Describe the botanical characteristics of the family **NAMED** in a).

c) Describe the horticultural value of **FOUR** genera from the family **NAMED** in a).

This question allowed candidates to demonstrate their knowledge of the flower structure of a typical member of their selected plant family, the botanical characteristics of the family and to name and describe four specific genera of horticultural value.

The plant family selected by the majority of candidates was Rosaceae. Most candidates drew a floral diagram to depict the numbers, arrangement and attachment of floral parts and labelled this, others drew a labelled half flower. Marks were awarded for clarity and accuracy of the diagram in depicting sepals, petals or perianth segments, stamens, carpels and also an indication of the numbers of ovules and placentation in the ovary.

When describing the botanical characteristics of the chosen family, many candidates repeated the information presented in part a) and could not be rewarded for this. Better candidates extended their answer to include growth habits, life cycles, characteristics of leaves, stems and roots as well as types of inflorescence and fruits.

Candidates generally exhibited good plant knowledge and described the horticultural value of four named genera from their selected plant family.

Q12 a) Describe, with the aid of diagrams, the process of meiosis.

b) State how the process of mitosis differs from meiosis.

c) State the role of mitosis and meiosis in the plant.

This question allowed candidates to demonstrate detailed knowledge of the process of meiosis, to identify the differences between mitosis and meiosis and to state the roles of both types of cell division.

Most candidates were able to describe the process of meiosis in outline, but few were able to draw clear diagrams that clarified the detailed process of meiosis producing four non identical haploid gametes from a diploid mother cell.

Candidate's answers should have described stages involved in the two divisions of Meiosis 1 and 2 and the behaviour of homologous chromosomes and their constituent chromatids including:
Prophase 1
Pairing of homologous chromosomes –synapsis
Crossing over- exchange of DNA between chromatids at chiasmata
Metaphase 1
Random alignment of homologous pairs of chromosomes around equator of spindle
Anaphase 1
Separation of homologous chromosomes with random assortment of maternal and paternal chromosomes to opposite poles of the spindle
Metaphase 2 and Anaphase 2
Individual chromosomes consisting of two non identical chromatids line up on equator of spindle.
Separated chromatids pulled to opposite poles
Telophase 2
Four haploid daughter cells formed all with different DNA
Good candidates produced a series of clear diagrams showing how four non – identical haploid gametes were formed from the original diploid mother cell.

Section C – Plant Physiology II

Q13 a) Explain why monoculture is normally adopted in horticultural crop production.

b) Explain why weeds are usually excluded from monocultures.

c) Explain how spacing in different crops can be manipulated to maximise yields.

The majority of candidates gave good answers to the first part of the question. The fact that growing plants to blueprint specification is easier with monoculture was not mentioned by many candidates. In addition the use of mechanical devices to assist growing by monoculture was omitted by the majority of candidates.

There were good answers on the effect of weeds on water and nutrient availability and the harbouring of pests and diseases. Very few candidates mentioned that mechanical harvesting relies on a weed free environment in order to maintain quality. In addition weeds will interfere with precise measurements in respect to blueprint growing of crops by monoculture.

The third part of the question presented more difficulty to candidates. The examiner was looking for examples of crop spacing to include; 100% crop coverage, machine spacing, raised bed systems, close spacing for crops to be used in the canning industry, leaf area index to relate to the cropping size of plant material.

Q14 a) Explain the action of:

i) abscisic acid in moderating water stress;
ii) ethylene in fruit ripening.
iii)

b) Describe the use of **NAMED** synthetic growth regulators in horticulture.

There were some good answers by candidates in respect of abscisic acid closing the stomata. Candidates who recorded information on abscisic acid interacting with auxin gained high marks.
The use of ethylene in order to ripen fruits if injected into the atmosphere at 1000 ppm was clearly explained. The majority of candidates however did not record information on how the application of chemical release agents onto the crop in the field will stimulate ethylene production naturally by the plant. Tomatoes can be ripened with ethylene after picking and in storage. Ethylene is an expensive chemical to apply and therefore is normally restricted to higher value crops.

There was some confusion in answers to part b) concerning the actual hormone contained in the named synthetic growth regulator.
The requirements of the Food and Environment Protection Act 1985 and the Pesticide Regulations 1986 were rarely mentioned by candidates.
Considerable confusion exists in respect to rooting powder/liquids. It is the cell differentiation which is important to understand. Clearly if the environment is suitable thereafter for roots to develop, the roots will develop more quickly.
The examiner was looking for examples of cell differentiation, reduction of internodes, reduction in grass growth, reduction of apical dominance with hedges, fruit thinning with apples and pears, hormonal herbicides and selective herbicides, tissue culture techniques, the stimulation of female flowers and plant breeding, the production of seedless fruit.
Very few candidates mentioned the public resistance to the use of synthetic plant growth regulators which has been a major concern in recent years.

Q15 a) Define ‘juvenility’ in plants.

b) Explain how ‘juvenility’ is manipulated in horticultural practice.

c) Describe the processes involved in the transition to the adult stage.

The term juvenility was very well explained by the majority of candidates. It is important however to ensure that there is a clear understanding of juvenility in respect to juvenile growth and juvenile stage of growth which can be present on the plant for several years.

Good answers were given by the majority of candidates on how growers/horticulturalists can maintain juvenility with plants such as Hedera and Eucalyptus.
The use of hard pruning to maintain juvenile growth was rarely mentioned by candidates.
The production of fruit with rootstocks to assist the production of fruit using juvenile scion material was not mentioned by candidates.
The advantages of using juvenile plant material especially with new cultivars/hybrids, was not fully explained by many candidates.

The final part of the question was poorly answered by the majority of candidates. The examiner noticed some very general answers which did not contain clear specific information.
The examiner was looking for information on: the leaf area index of the plant, the difference between physiological age and development age of the plant, the concept of photoperiodism with named plant examples of short-day and long-day plants, the effect of the height of the plant above ground level in relation to changes from juvenile to adult growth and the hormonal activity within the plant and relationship with apical dominance.

Q16 a) Describe the effects of temperature on plants.

b) Describe how temperature can be manipulated to optimise plant growth and development.

There were some very general answers from candidates which did not provide detailed information. The examiner was looking for: the relationship between photosynthesis and respiration, the initiation of the flower, dormancy in seed and buds, heating at the base of cuttings to encourage respiration and low temperatures at the tip to reduce respiration, the heat treatment of grafted plants, the development of forced ornamental bulbs such as Hyacinthus, the storage of fruit, vegetables and flowers and the relationship between temperature and relative humidity.

For the second part of the question the majority of candidates gave very good answers. Candidates who could mention clear examples of temperature manipulation gained high marks. The examiner was looking for; the control of temperature in protective structures including double skin polythene tunnels, partial sterilisation by steam or electric element sterilisers, heat treatments to break bud dormancy, the manipulation of respiration by temperature at seed germination stage, the effect of windbreaks in reducing temperatures, the greenhouse effect, the use of black polythene mulches to heat up soil for seed sowing outside in spring, the use of mist water spraying in fruit orchards to reduce frost damage by the release of latent heat, and the storage of fruit and vegetables in controlled storage environments.