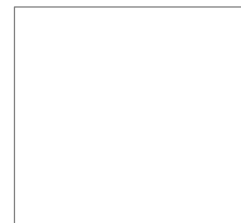




Inspiring everyone to grow



R2102

PLANT NUTRITION & THE ROOT ENVIRONMENT

Level 2

Monday 11 February 2019

11:20 – 12:10

Written Examination

Candidate Number:

Candidate Name:

Centre Number/Name:

IMPORTANT – Please read carefully before commencing:

- i) The duration of this paper is **50** minutes;
- ii) **ALL** questions should be attempted;
- iii) **EACH** question carries **10 marks**;
- iv) Write your answers legibly in the lined space provided. It is **NOT** necessary that all lined space is used in answering the questions;
- v) Use **METRIC** measurements only;
- vi) Use black or blue ink only. Pencil can be used for drawing purposes only;
- vii) Where plant names are required, they should include genus, species and where appropriate, cultivar;
- viii) Where a question requires a specific number of answers; only the first answers given that meet the question requirement will be accepted, regardless of the number of answers offered;
- ix) Please note, when the word '**distinct**' is used within a question, it means that the items have different characteristics or features.

ANSWER ALL QUESTIONS

MARKS

Q1 a) State the meaning of **EACH** of the following terms:

- i) soil texture;
- ii) soil structure.

2
2

i)

.....

.....

.....

.....

.....

.....

.....

.....

.....

.....

.....

.....

.....

.....

.....

.....

.....

.....

.....

.....

.....

.....

.....

.....

.....

.....

b) Describe the characteristics of **TWO NAMED** organic materials that can be added to the soil.

6

Total Mark

Please see over/.....

MARKS

Q2 a) State the pH range found in soils.

1

.....

.....

.....

.....

b) State **THREE** distinct reasons why the pH of soil needs to be considered when growing garden plants.

3

.....

.....

.....

.....

.....

.....

.....

.....

.....

c) Identify which materials have a pH that is acid, neutral or alkaline by placing a tick in **ONE** column in the table below:

6

Material	Acid	Neutral	Alkaline
Peat			
Coir			
Green manures			
Composted bracken			
Wood ash			
Ammonium sulphate			

Total Mark

Please turn over/.....

Q5 a) Name **THREE** plant nutrients and describe **ONE** symptom of deficiency for **EACH** by completing the table below:

Plant nutrient	Symptom of deficiency
1.	
2.	
3.	

2

2

2

b) State what is meant by **EACH** of the following terms:

- i) liquid feed;
- ii) foliar feed;
- iii) slow release fertiliser;
- iv) controlled release fertiliser.

1

1

1

1

i).....

.....

.....

.....

ii).....

.....

.....

iii).....

.....

.....

.....

iv).....

.....

.....

.....

Total Mark

Please see over/.....

MARKS

Q6 a) State **ONE** limitation of using garden soil in containers.

1

.....
.....
.....
.....
.....

b) Describe the characteristics of **THREE** distinct **NAMED** types of growing media (excluding garden soil) used for plants in containers by completing the table below:

Name of growing medium	Characteristics
1.	
2.	
3.	

3

3

3

Total Mark

**©These questions are the property of the Royal Horticultural Society.
They must not be reproduced or sold.**

**The Royal Horticultural Society, Wisley, Woking, Surrey GU23 6QB.
Charity Registration Number: 222879/SC038262**

R2102

PLANT NUTRITION & THE ROOT ENVIRONMENT

Level 2

Monday 11 February 2019

Candidates Registered	998		Total Candidates Passed	741	90%
Candidates Entered	827	83%	Passed with Commendation	406	49%
Candidates Absent/Withdrawn	153	15%	Passed	335	41%
Candidates Deferred	18	2%	Failed	86	10%

Senior Examiner's Comments:

- Candidates should be able to demonstrate a good range of plant knowledge and be able to give accurately named plant examples where appropriate. Common names and generic names are often too vague and cannot be rewarded in the positive manner that genus, species and where appropriate, variety/cultivar can. This is particularly important when answering questions relating to particular (named) plant(s). Marks can only be awarded for these narratives where the example(s) are correctly and fully identified.
- Candidates must be able to display accurate knowledge of the technical terms and concepts detailed in the syllabus, in the context of horticulture and also be aware that wider interpretation will not be rewarded. The examination should be regarded as a possible introduction to higher level studies, which will only be open to those who are in possession of a clear understanding of the horticultural terms and concepts which are current.
- The introductory rubric given on the first page of each question paper should be read carefully by candidates. At each examination there are a significant number of candidates who ignore or misread the instructions given and consequently may not perform as well as they could have done.

- 4** Candidates should pace themselves during each paper. The most successful candidates allow sufficient time to read the question thoroughly before answering it and also take time to read through their answers. They should take care to write as legibly as possible, so that the examiner is in no doubt about what is intended.

- 5** Candidates need to interpret key words within questions, particularly those such as 'state', 'list' and 'describe'. Questions requiring descriptions or explanations obviously require a more detailed answer than those requiring a list.

- 6** It is important to ensure that responses to questions are to the point. Candidates should bear in mind that small sketches might be used to convey information more succinctly than words.

- 7** Successful candidates ensure that their answers are focused and to the point. It is disappointing when they cannot be rewarded for their efforts because the answer is irrelevant to the particular question. Candidates should take note of the mark allocation for specific sections and allocate their time and efforts accordingly.

- 8** Diagrams can enhance an answer and where appropriate can replace detailed descriptions. They should be large, clear and well annotated, ensuring that labels are properly attached to the features they describe. Diagrams should preferably be in pencil. Colour may be used successfully but only where it is relevant to the answer.

- 9** In each examination it is clear that some candidates are ill prepared to answer papers of the type set. It is essential that candidates have the opportunity to practice questions. Ideally some papers should be answered in a time constrained situation. Appropriate feedback must, in any case be provided.

Q1 a) State the meaning of **EACH** of the following terms:

- | | |
|---------------------|----------|
| i) soil texture; | 2 |
| ii) soil structure. | 2 |

b) Describe the characteristics of **TWO NAMED** organic materials that can be added to the soil. **6**

Q1a) Candidates who were able to state the meaning of the specific terms were awarded full marks. Acceptable answers included:

- i) **Soil texture** is the relative proportions and size of sand, silt and clay in a given soil.

Marks were also awarded to candidates who stated that the feel of the soil i.e. gritty, soapy or smooth enabled the type of soil; sand, silt or clay to be identified.

- ii) **Soil structure** is the arrangement of soil particles into aggregates/crumbs as well as the presence of air, water and a small amount of organic matter.

Candidates who described soil profiles could not be awarded any marks.

Candidates who stated the terms soil texture and soil structure the wrong way round could not be awarded any marks.

Q1b) Maximum marks were gained by candidates who clearly described the characteristics of organic materials in the form of bulky organic manure, garden compost, spent mushroom compost and leaf mould. Suitable descriptions included:

Farm yard manure needs to be well rotted to avoid scorching plants and is low in nutrients but is applied in bulk. Farm yard manure improves the water retention of the soil and opens up the structure.

Leaf mould is low in nutrients and has an open fibrous structure. It has a variable pH but is usually acidic.

Spent mushroom compost consists of rotted farm yard manure, peat and lime. It has a high pH and decomposes quickly.

Q2 a) State the pH range found in soils.

1

b) State **THREE** distinct reasons why the pH of soil needs to be considered when growing garden plants.

3

c) Identify which materials have a pH that is acid, neutral or alkaline by placing a tick in **ONE** column in the table below:

6

Material	Acid	Neutral	Alkaline
Peat			
Coir			
Green manures			
Composted bracken			
Wood ash			
Ammonium sulphate			

Q2a) The majority of candidates correctly stated that the pH range found in soils is 4 – 8 and gained full marks.

Candidates who stated the whole pH range as a value i.e. 0 – 14 could not be awarded any marks.

Q2b) The best candidates stated a range of reasons why the pH of soil needs to be considered when growing garden plants. Suitable answers included:

- Plants may require different growing conditions (calcifuge and calcicole) to ensure healthy growth.
- The availability of nutrients in the soil depends on soil pH e.g. calcium and phosphorus are less available at lower pH levels.
- Iron is less available in alkaline soils with a higher pH level which causes lime-induced chlorosis in calcifuge plants.
- Soil micro-organisms are affected by soil pH and are less prevalent in an acid soil.
- Certain diseases e.g. club root in brassicas is more prevalent in a soil with a lower pH level.

Q2c) Candidates who were able to identify the pH of specific materials gained full marks. Correct answers were:

- Peat** – acid
- Coir** – neutral
- Green manure** – acid
- Composted bracken** – neutral
- Wood ash** – alkaline
- Ammonium sulphate** – acid

Q3 a) State **ONE** distinct benefit **AND ONE** distinct limitation for each of the following horticultural practices, excluding cost, by completing the table below:

	Benefit	Limitation
Garden irrigation		
Garden drainage systems		

2

2

b) State **THREE** distinct benefits of **EACH** of the following methods that are used to improve the root environment:

- i) no dig method of soil management;
- ii) cultivation by digging garden soil.

3

3

Q3a) A range of suitable benefits and limitations of the specific horticultural practices were given by the best candidates who gained maximum marks. These included:

Garden irrigation

Benefits

- Consistent watering process.
- Larger areas of plants can be watered more effectively.
- Automation/timers can be used to control the amount of water.
- Regular system of watering will benefit plant growth and development.

Limitations

- Surface capping of soil as a result of the delivery of water.
- Leaching of nutrients.
- Overwatering can occur.
- Water may not always be delivered to where it is required.

Garden drainage systems

Benefits

- Avoids or reduces water logging.
- Improves the drainage of e.g. a clay soil which is not free draining.
- Reduces the water table in a soil where it is high.

Limitations

- Disturbance of the soil when installing a drainage system.
- Disturbance of soil profile may impact on plant growth.
- Compaction of the soil due to the use of heavy machinery when installing drainage systems.

Q3b) The majority of candidates were able to state appropriate benefits of the specific methods that are used to improve the root environment and were awarded full marks.

- i) In a no dig method of soil management the soil is left undisturbed and therefore does not disturb/affect the microorganisms present in the soil. There is no soil compaction as no heavy machinery is used and the soil is not stood on which prevents any damage occurring to the soil structure. Soil pans are also avoided as digging to the same depth does not take place and also avoids weed seeds being brought to the soil surface which prevents competition for nutrients etc.

- ii) Cultivation by digging garden soil enables soil pans to be broken up and the incorporation of bulky organic matter to take place which improves the soil structure. Digging aerates the soil, improves drainage and exposes pests to predators. Weeds can also be removed by hand or incorporated into the soil.

Q4 a) Describe **THREE** environmental implications of composting garden waste. **6**

b) Identify **THREE** correct statements from the table below which are important for making good compost: **3**

Statement	Tick ✓
At least half of the materials should be woody	
Larger materials need to be reduced in size	
The compost should be kept very dry	
Always add soil in between layered material	
The compost should be well aerated	
There should be more green material than woody material	
The compost needs to be well compacted	

c) Name **TWO** major plant nutrients that can be found in garden compost. **1**

Q4a) The environmental implications of composting garden waste was described well by many candidates who were awarded full marks. Suitable answers included:

- There is no need to take garden waste to landfill sites
- Recycling and reusing nutrients in the soil will reduce the need to purchase fertiliser or growing media
- Hot composting will kill weed seeds and annual weeds whereas cold composting will not which could cause weed seeds and weeds to be spread around the garden
- Soil micro-organisms will multiply in the composting process which will also benefit garden soil

Q4b) Full marks were gained by candidates who identified the correct statements which are important for making good compost. These were:

- At least half of the materials should be woody
- Larger materials need to be reduced in size
- The compost should be well aerated

Q4c) Most candidates were able to name major plant nutrients found in garden compost i.e. nitrogen, phosphorus, potassium, calcium, magnesium, sulphur and gained maximum marks

Q5 a) Name **THREE** plant nutrients and describe **ONE** symptom of deficiency for **EACH** by completing the table below:

Plant nutrient	Symptom of deficiency
1.	
2.	
3.	

2
2
2

b) State what is meant by **EACH** of the following terms:

- i) liquid feed;
- ii) foliar feed;
- iii) slow release fertiliser;
- iv) controlled release fertiliser.

1
1
1
1

Q5a) Suitable descriptions of deficiency symptoms for named plant nutrients were provided by many candidates who gained maximum marks. These included:

Nitrogen – stunted growth and chlorosis on the older leaves first.

Phosphorus – stunted new growth and weak, poor root development. Older leaves turn purple/green and have short thin stalks.

Potassium – poor fruit and flower development. Older leaves become scorched and curl before the younger leaves.

Calcium - localised tissue necrosis which leads to stunted growth, necrotic leaf margins on young leaves or curling of leaves which leads to the death of terminal buds and root tips. New /rapidly growing parts of the plant are affected first. ‘Bitter pit’ in apples and ‘blossom end rot’ in tomatoes are caused by a deficiency of calcium.

Other nutrients that were named and deficiency symptoms described included magnesium and iron and were awarded marks.

Q5b) The majority of candidates were able to state the meaning of the specific terms and were awarded full marks. Suitable answers included:

- i) **Liquid feed** – is concentrated and needs to be diluted. It is applied to the soil around the base of the plant as a drench at intervals during the growing season.
- ii) **Foliar feed** – once diluted is applied directly onto the leaves of the plant. It is fast acting as it is absorbed through the stomata of the leaf.
- iii) **Slow release fertiliser** – e.g. bonemeal are usually organic and release their nutrients into the soil as a result of being watered in and dissolving slowly over a period of time due to warmth, moisture and micro-organisms in the soil.
- iv) **Controlled release fertiliser** – e.g. Osmocote. Each granule is covered with an organic, semi-permeable coating of biodegradable resin which is made of vegetable oils. Water penetrates the semi-permeable coating and starts to dissolve the nutrients present in the granule. The release of nutrients starts once they have been dissolved. The optimum temperature for the release of nutrients is 21°C. Controlled release fertiliser is available in a range of longevities.

Q6 a) State **ONE** limitation of using garden soil in containers.

1

b) Describe the characteristics of **THREE** distinct **NAMED** types of growing media (excluding garden soil) used for plants in containers by completing the table below:

Name of growing medium	Characteristics
1.	
2.	
3.	

3

3

3

Q6a) A range of limitations of using garden soil in containers were provided by candidates who gained maximum marks. Suitable answers included:

- Soil may contain pests and weed seeds
- The nutrient content of the soil is not known
- The structure of the soil may not be suitable as it could slump causing less oxygen to be available for the roots of the plant
- Soil type may not be suitable for the type of plant being grown
- Soil may be too heavy if the containers need to be moved

Q6b) The best candidates named a range of suitable growing media e.g. coir based, peat based, composted bark based, JI No.1, seed compost, ericaceous compost etc. Those candidates who provided appropriate characteristics for each type of growing media gained full marks. Acceptable answers included:

Coir based – is light weight, has a high water holding capacity with good porosity and air content. It is pH neutral and is sustainable.

Peat based – has a pH level which is acidic, is naturally sterile, has an excellent structure, well aerated, and a high water holding capacity but is difficult to re-wet once it has dried out.

Composted bark based – bark is non-clumping with an open, stable structure and is well aerated. It has a low water holding capacity and has a variable pH value.
