



Royal  
Horticultural  
Society

Including Examiners comments



Sharing the best in Gardening

**R2102**

**PLANT NUTRITION & THE ROOT ENVIRONMENT**

**Level 2**

**Monday 19 June 2017**

**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.

Ofqual Unit Code R/505/2834

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

## ANSWER ALL QUESTIONS

**Q1 a)** Identify **TWO** situations where a rotary soil cultivator could be used.

**MARKS**

**2**

.....

.....

.....

.....

.....

.....

.....

.....

.....

.....

**b)** State **TWO** types of damage caused to the soil by rotary cultivation.

**4**

.....

.....

.....

.....

.....

.....

.....

.....

.....

.....

.....

.....

.....

.....

.....

.....

.....

.....

.....

.....

.....

.....

.....

**c)** State **TWO** effects to plant growth as a result of rotary cultivation.

**4**

.....

.....

.....

.....

.....

.....

.....

.....

.....

.....

.....

.....

.....

.....

.....

.....

.....

.....

.....

.....

.....

.....

Total Mark
------------

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

**MARKS**

**Q2 a)** State **TWO** limitations of **EACH** of the following materials when used to increase the organic matter content of soils:

- i) composted green waste (municipal waste);
- ii) garden compost;
- iii) mushroom compost.

**2**  
**2**  
**2**

i).....

.....

.....

.....

ii).....

.....

.....

.....

iii).....

.....

.....

.....

**b)** Describe how **EACH** of the following types of organic matter can be used in a garden situation:

- i) chipped bark;
- ii) farm yard manure (FYM).

**2**  
**2**

i).....

.....

.....

.....

.....

.....

ii).....

.....

.....

.....

.....

.....

.....

Total Mark

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

**MARKS**

**Q3 a)** State what is meant by the term 'acidic pH'.

**2**

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

**b)** Draw a circle around **SIX** materials which increase acidity when incorporated into garden soils.

**6**

**spent mushroom compost**

**peat**

**chalk**

**loam**

**dolomite**

**composted bracken**

**marble chips**

**pine needles**

**aluminium sulphate**

**flowers of sulphur**

**ferrous sulphate**

**green manure**

**c)** Name **TWO distinct** plant examples that require an acid soil for growth.

**2**

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

Total Mark
------------

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

**Q4 a)** List **SIX** materials used in composting, **THREE** with high Nitrogen, and **THREE** with high Carbon content by completing the table below.

High carbon content	High nitrogen content
1.	
2.	
3.	

2

2

2

b) Describe **ONE** method to make garden compost from bulky organic materials.

4

.....

.....

.....

.....

.....

.....

.....

.....

.....

.....

.....

.....

.....

.....

.....

.....

.....

.....

.....

.....

.....

.....

.....

Total Mark
------------

Please turn over/.....

**MARKS**

**Q5 a)** Name suitable examples for **EACH** of the following types of plant nutrient:

**THREE** Major nutrients;

**3**

i).....

ii).....

iii).....

**ONE** Minor nutrient.

**1**

i).....

**b)** State the role of **ONE** of the major nutrients listed in a).

**2**

.....

.....

.....

.....

**c)** State **TWO** characteristics for **EACH** of the following types of fertiliser by completing the table below (excluding cost and environmental implications).

Characteristic	Organic	Inorganic
1.		
2.		

**2**

**2**

Total Mark
------------

Please see over/.....

**MARKS**

**Q6 a) State THREE effects of compaction in soil.**

**3**

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

**b) State TWO effects of compaction of soil on plant growth.**

**2**

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

**c) Describe how soil compaction can be reduced in a garden situation.**

**5**

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

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**





Royal  
Horticultural  
Society

Sharing the best in Gardening

**R2102**

**PLANT NUTRITION & THE ROOT ENVIRONMENT**

**Level 2**

**Monday 19 June 2017**

<b>Candidates Registered</b>	<b>635</b>		<b>Total Candidates Passed</b>	<b>463</b>	<b>85.58%</b>
Candidates Entered	541	85.20%	Passed with Commendation	258	47.69%
Candidates Absent/Withdrawn	84	13.23%	Passed	205	37.89%
Candidates Deferred	10	1.57%	Failed	78	14.42%

**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.

	<b>MARKS</b>
<b>Q1 a)</b> Identify <b>TWO</b> situations where a rotary soil cultivator could be used.	<b>2</b>
b) State <b>TWO</b> types of damage caused to the soil by rotary cultivation.	<b>4</b>
c) State <b>TWO</b> effects to plant growth as a result of rotary cultivation.	<b>4</b>

**Q1a)** Most candidates were able to identify a range of situations where a rotary soil cultivator could be used and gained full marks. Suitable answers included; preparation of the ground to create a tilth for sowing seeds, turfing or seeding a lawn or a flower border, incorporation of farm yard manure or green manures, control of annual weeds when preparing a stale seedbed and to break up a soil cap.

**Q1b)** Candidates stated a range of types of damage caused to the soil by rotary cultivation and were awarded maximum marks. These included:

- Rotary cultivation carried out at the same depth repeatedly may cause a soil pan to form
- Soil will be broken down to a very fine tilth and may form a surface cap following heavy rain/irrigation
- Soil structure is affected by the loss of crumb structure
- Loss of soil structure could lead to soil erosion/wind erosion

**Q1c)** The best candidates were able to state the effects to plant growth as a result of rotary cultivation and gained maximum marks. Acceptable answers included:

- A soil cap formed as a result of overusing a rotary cultivator would lead to restrictions in air exchange and water infiltration which would lead to restricted seedling emergence and development
- A soil pan which is a result of cultivating to the same depth leads to a reduced depth of rooting and a lack of plant stability
- Rotary cultivation will chop up weeds which is beneficial as they compete for water and nutrients

**MARKS**

**Q2 a)** State **TWO** limitations of **EACH** of the following materials when used to increase the organic matter content of soils:

- i) *composted green waste (municipal waste);* **2**
- ii) *garden compost;* **2**
- iii) *mushroom compost.* **2**

b) Describe how **EACH** of the following types of organic matter can be used in a garden situation:

- i) *chipped bark;* **2**
- ii) *farm yard manure (FYM).* **2**

**Q2a)** To gain maximum marks candidates were required to state specific limitations of each of the materials. Suitable answers included:

- i) **Composted green waste (municipal waste)** can contain contaminants e.g. glass/plastic. The variation of materials in it can influence the pH e.g. approximately pH 6 in January, due to the addition of Christmas trees and pH 7.5 later in the year.
- ii) **Garden compost** requires the correct mix of materials i.e. a ratio of 30:1 carbon to nitrogen for complete breakdown. It may also contain weed seeds if the temperature was not high enough.
- iii) **Mushroom compost** is alkaline due to the addition of lime. Continual use of mushroom compost could lead to lime induced chlorosis of plants.

**Q2b)** Most candidates were able to describe how specific types of organic matter can be used in a garden situation and were awarded full marks.

- i) **Chipped bark** can be used as a mulch to retain moisture and to suppress weeds around shrubs in borders at a depth of 50-100mm.
- ii) **Farm Yard Manure (FYM)** is usually incorporated into the soil in autumn to improve soil structure. It can also be left on top of the soil over winter or used around roses, rhubarb or soft fruit.

**MARKS**

- Q3 a)** State what is meant by the term 'acidic pH'. **2**
- b) Draw a circle around **SIX** materials which increase acidity when incorporated into garden soils. **6**

**spent mushroom compost**

<b>peat</b>	<b>chalk</b>	<b>loam</b>
<b>dolomite</b>	<b>composted bracken</b>	<b>marble chips</b>
<b>pine needles</b>	<b>aluminium sulphate</b>	
<b>flowers of sulphur</b>		
<b>ferrous sulphate</b>	<b>green manure</b>	

- c) Name **TWO distinct** plant examples that require an acid soil for growth. **2**

- Q3a)** The majority of candidates stated that the term acidic pH is the concentration of hydrogen ions which has a pH below pH 7 within the range of 1-6.9 and gained maximum marks.
- Q3b)** Candidates who circled the materials which increase acidity in garden soils achieved full marks. These were; peat, pine needles, composted bracken, ferrous sulphate, aluminium sulphate and flowers of sulphur.
- Q3c)** The majority of candidates correctly named distinct plants which require an acid soil for growth. Acceptable answers included; *Rhododendron luteum*, *Camellia japonica* and *Pieris japonica*.

**MARKS**

**Q4 a)** List **SIX** materials used in composting, **THREE** with high Nitrogen, and **THREE** with high Carbon content by completing the table below.

<b>High carbon content</b>	<b>High nitrogen content</b>
<b>1.</b>	
<b>2.</b>	
<b>3.</b>	

**2**

**2**

**2**

**b)** Describe **ONE** method to make garden compost from bulky organic materials.

**4**

**Q4a)** Candidates provided a range of suitable materials used in composting which have either a high nitrogen or carbon content and were awarded full marks. Acceptable answers included:

**High carbon content** e.g. woody prunings, bark chips, non-glossy paper products, straw, fallen deciduous leaves and shredded branches.

**High nitrogen content** e.g. grass cuttings, crop debris, soft/green prunings, kitchen peelings and annual weeds.

**Q4b)** Most candidates described a suitable method to make garden compost and gained maximum marks. The best descriptions included the following details:

- Use of a suitable container to hold the materials e.g. plastic or wooden slatted bin which has a volume of 1m<sup>3</sup>
- Place the container which is open to the ground on bare soil to enable soil organisms to enter
- Materials are placed in 150mm layers e.g. those containing high levels of carbon or nitrogen
- Provide a lid/cover for the container to prevent excess watering entering
- Turn the materials every month to ensure aerobic conditions are maintained
- Water the contents of the container to prevent the materials becoming too dry

**MARKS**

**Q5 a)** Name suitable examples for **EACH** of the following types of plant nutrient:

**THREE** Major nutrients;

**3**

i).....

ii).....

iii).....

**ONE** Minor nutrient.

**1**

i).....

b) State the role of **ONE** of the major nutrients listed in a).

**2**

c) State **TWO** characteristics for **EACH** of the following types of fertiliser by completing the table below (excluding cost and environmental implications).

<b>Characteristic</b>	<b>Organic</b>	<b>Inorganic</b>
<b>1.</b>		
<b>2.</b>		

**2**

**2**

**Q5a)** The majority of candidates were able to name appropriate examples of specific plant nutrients and were awarded full marks. Suitable examples included:

**Major nutrients** – Nitrogen, Phosphorus, Potassium, Calcium, Magnesium

**Minor nutrients** – Iron, Boron, Manganese

**Q5b)** The best candidates clearly stated the role of a major nutrient and gained full marks. Acceptable answers included:

**Nitrogen** is used in amino acids, proteins and nucleic acids. It therefore leads to growth. Nitrogen is also a constituent of enzymes and so is important for chlorophyll.

**Phosphorus** is used in nucleic acids and in membrane development. It is required in energy (ATP) processes of the plant e.g. respiration and supports root and shoot development.

**Q5c)** Candidates were able to state a range of characteristics for each of the specific types of fertiliser and achieved full marks.

#### **Organic Fertilisers**

- Naturally occurring
- Able to increase the quality of the soil if used over a long period of time
- Tend to be released in warm and moist conditions
- Slow release
- Limited fossil fuels used in production

#### **Inorganic Fertilisers**

- Known chemical composition
- Controlled release available as pellets/granules e.g. Osmocote
- Not necessarily obtained from natural sources
- May contribute to run off if used in excess
- Specific mixes for specific purposes

**MARKS**



- Q6 a)** State **THREE** effects of compaction in soil. **3**
- b) State **TWO** effects of compaction of soil on plant growth. **2**
- c) Describe how soil compaction can be reduced in a garden situation. **5**

**Q6a)** Many candidates were awarded full marks for stating a range of effects of compaction in soil. Suitable answers included:

- Soil particles become squashed/move closer together
- Less water held in soil
- Less air present
- Reduction in the volume of soil
- Impeded drainage

**Q6b)** Most candidates provided a suitable range of effects of compaction of soil on plant growth and gained maximum marks. These included:

- Poor root penetration
- Less water/nutrient uptake
- Lower yield from crops
- Germination impeded
- Reduced aerobic respiration which affects root growth

**Q6c)** Good descriptions how soil compaction can be reduced in a garden situation were provided by the best candidates who were awarded full marks. The following points were included in their descriptions.

- Single or double dig or rotovate below the soil pan to open up the soil and break up the soil pan
- If the soil is very dense incorporate sand/grit into it to increase the pore space
- Vary the depth of cultivation each year
- Cultivate the soil at the correct time of year
- Do not over irrigate the soil
- Avoid walking on wet soil
- Incorporate organic matter into the soil to improve the pore space

\*\*\*\*\*