Government of **Western Australia**
School Curriculum and Standards Authority

WACE
Western Australian Certificate of Education

Western Australian Certificate of Education Examination, 2014

Question/Answer Booklet

PLANT PRODUCTION SYSTEMS

Stage 3

Please place your student identification label in this box

Student Number: In figures | | | | | | | | | |

In words _____

_____

Time allowed for this paper

Reading time before commencing work: ten minutes
Working time for paper: three hours

Materials required/recommended for this paper

To be provided by the supervisor

This Question/Answer Booklet
Multiple-choice Answer Sheet

Number of additional answer booklets used (if applicable): ☐

To be provided by the candidate

Standard items: pens (blue/black preferred), pencils (including coloured), sharpener, correction fluid/tape, eraser, ruler, highlighters

Special items: non-programmable calculators approved for use in the WACE examinations

Important note to candidates

No other items may be taken into the examination room. It is **your** responsibility to ensure that you do not have any unauthorised notes or other items of a non-personal nature in the examination room. If you have any unauthorised material with you, hand it to the supervisor **before** reading any further.

Ref: 14-118

Structure of this paper

Section	Number of questions available	Number of questions to be answered	Suggested working time (minutes)	Marks available	Percentage of exam
Section One: Multiple-choice	15	15	20	15	15
Section Two: Short answer	7	7	90	89	50
Section Three: Production practices	1	1	30	30	15
Section Four: Extended answer	3	2	40	40	20
				Total	100

Instructions to candidates

1. The rules for the conduct of Western Australian external examinations are detailed in the *Year 12 Information Handbook 2014*. Sitting this examination implies that you agree to abide by these rules.

2. Answer the questions according to the following instructions.

   Section One: Answer **all** questions on the separate Multiple-choice Answer Sheet provided. For each question, shade the box to indicate your answer. Use only a blue or black pen to shade the boxes. If you make a mistake, place a cross through that square, then shade your new answer. Do not erase or use correction fluid/tape. Marks will not be deducted for incorrect answers. No marks will be given if more than one answer is completed for any question.

   Sections Two, Three and Four: Write your answers in this Question/Answer Booklet.

3. You must be careful to confine your responses to the specific questions asked and to follow any instructions that are specific to a particular question.

4. Spare pages are included at the end of this booklet. They can be used for planning your responses and/or as additional space if required to continue an answer.
   - Planning: If you use the spare pages for planning, indicate this clearly at the top of the page.
   - Continuing an answer: If you need to use the space to continue an answer, indicate in the original answer space where the answer is continued, i.e. give the page number. Fill in the number of the question that you are continuing to answer at the top of the page.

See next page

Section One: Multiple-choice **15% (15 Marks)**

This section has **15** questions. Answer **all** questions on the separate Multiple-choice Answer Sheet provided. For each question, shade the box to indicate your answer. Use only a blue or black pen to shade the boxes. If you make a mistake, place a cross through that square, then shade your new answer. Do not erase or use correction fluid/tape. Marks will not be deducted for incorrect answers. No marks will be given if more than one answer is completed for any question.

Suggested working time: 20 minutes.

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1. Soil erosion is an example of a

   (a) negative feedback loop.
   (b) positive feedback loop.
   (c) neutral feedback loop.
   (d) nutrient deficiency symptom.

2. Training farm staff in the safe operation of machinery is considered

   (a) good practice.
   (b) an ethical requirement.
   (c) a duty of care.
   (d) quality assurance.

3. In what conditions will plants transpire more quickly?

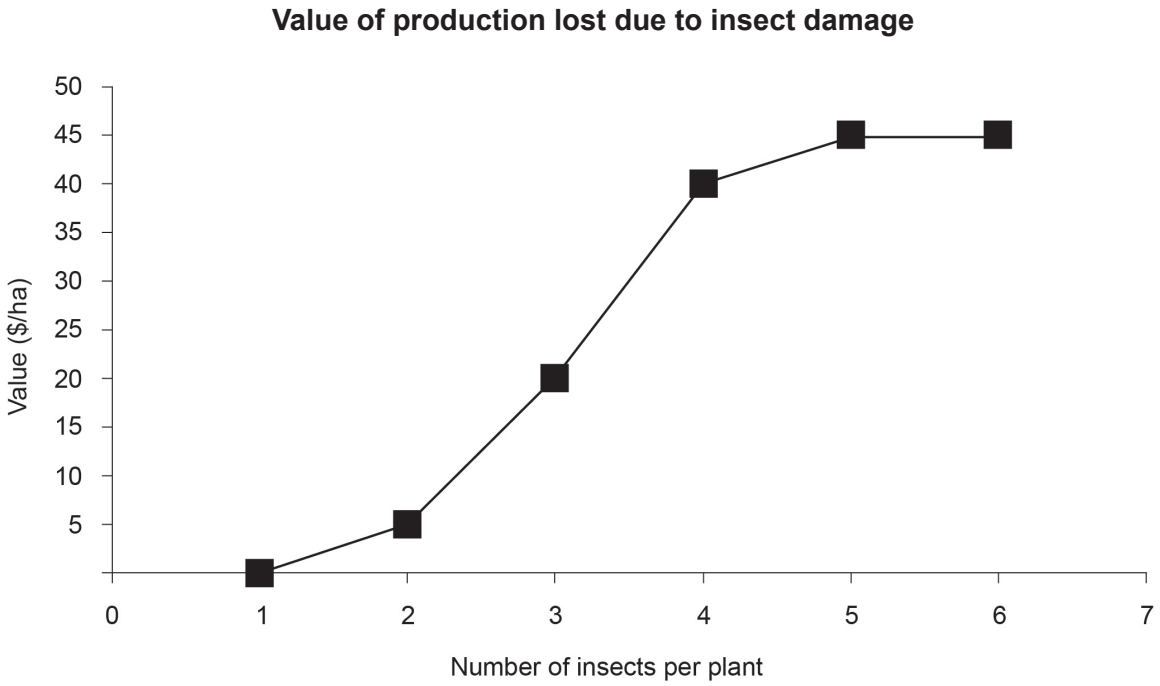
   (a) low humidity
   (b) high humidity
   (c) low rainfall
   (d) high rainfall

4. State border restrictions on plant product movement are important for preventing

   (a) local outbreaks of pests and diseases.
   (b) international outbreaks of pests and diseases.
   (c) seed contamination of plant varieties.
   (d) national outbreaks of pests and diseases.

See next page

Questions 5 and 6 are based on the following graph:



5. If the cost of controlling the insect is $20/ha, then the economic injury level is

   (a) 1 insect per plant.
   (b) 2 insects per plant.
   (c) 3 insects per plant.
   (d) 4 insects per plant.

6. Control measures should be considered at the economic threshold, which is the

   (a) same as the economic injury level.
   (b) level of pest above the economic injury level.
   (c) level of economic loss when pest damages the plant.
   (d) level of pest when economic loss occurs to the plant.

7. Which one of the following is **not** a valid ethical concern about the genetic modification (GM) of plants?

   (a) Cross contamination with non-GM plants can occur.
   (b) Consuming genes is bad for our health.
   (c) Large multinational firms could control the food supply.
   (d) Humans interfering with genes is considered unnatural.

See next page

8. Rehabilitating a salt-affected paddock with perennial plants is an example of

(a) a sustainable approach to achieve a long-term goal of reducing salinity.
(b) an immediate approach to reduce salinity in the short term.
(c) a duty of care to prevent salinity reducing crop yields.
(d) a legal requirement to lessen the impact of climate change.

Questions 9 and 10 refer to the following table, which summarises financial information for different grain enterprises within a farm.

	Wheat	**Barley**	**Lupins**
Area of land (ha)	1200	500	600
Income ($/ha)	570	477	481
Estimated total variable costs ($/ha)	520	380	460

9. Which enterprise makes more money and why?

(a) Barley, because it has the lowest variable costs.
(b) Wheat, because it is sown across a large area of the farm.
(c) Lupins, because they have the lowest gross margin.
(d) Wheat, because it has the highest gross margin.

10. Which enterprise would you recommend the producer sow more of and why?

(a) Barley, because it has the highest gross margin.
(b) Lupins, because they fix nitrogen.
(c) Wheat, because prices are more stable.
(d) Wheat, because it is most profitable.

11. Which one of the following is an example of a new technology to improve plant yield?

(a) fruit harvesters that reduce the number of labourers
(b) online software applications that monitor and lock in grain prices
(c) weed seeker technology that reduces weed competition with crops
(d) variable rate technology to reduce fertiliser waste

12. Soil water availability is the difference between

(a) irrigation rate applied to the soil and transpiration rate of the plant.
(b) total rainfall and plant water uptake.
(c) field capacity of the plant and wilting point of the soil.
(d) field capacity of the soil and wilting point of the plant.

See next page

Questions 13–15 relate to the soil nitrogen (N) data in the table below, showing results of replicate soil samples.

Total soil nitrogen (nitrate and ammonium) at end of season (mg N/kg soil)

Enterprise	Replicate 1	Replicate 2	Replicate 3	Replicate 4
Legume pasture	22	28	34	26
Wheat crop	12	15	19	18

13. How do you know which enterprise produces more soil nitrogen?

(a) Legume pasture, because the average soil N level is higher than wheat.
(b) Legume pasture, because it can fix atmospheric N.
(c) Wheat, because more nitrogen is removed with harvest.
(d) Wheat, because the average soil N is lower than the legume pasture.

14. The standard deviation for the data set was 5.0 for legume pasture and 3.2 for wheat, which indicates that

(a) there was more variability in the wheat data.
(b) nitrogen levels were more variable in wheat.
(c) nitrogen levels were higher in the legume pasture.
(d) there was more variability in the legume pasture data.

15. How could a producer use the data to manage plant nutrition across the enterprises?

(a) Only grow legume pastures to maximise N levels.
(b) Only grow wheat crops and apply more fertiliser.
(c) Apply more N fertiliser to wheat soil and sow wheat after pasture.
(d) Apply more N fertiliser to pasture soil and sow wheat after pasture.

End of Section One

See next page

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See next page

Section Two: Short answer **50% (89 Marks)**

This section has **seven (7)** questions. Answer **all** questions. Write your answers in the spaces provided.

Spare pages are included at the end of this booklet. They can be used for planning your responses and/or as additional space if required to continue an answer.

- Planning: If you use the spare pages for planning, indicate this clearly at the top of the page.
- Continuing an answer: If you need to use the space to continue an answer, indicate in the original answer space where the answer is continued, i.e. give the page number. Fill in the number of the question that you are continuing to answer at the top of the page.

Suggested working time: 90 minutes.

Question 16 **(14 marks)**

Plant hormones are chemical signals that are essential for plant functioning.

(a) (i) Name a plant hormone and one of its physiological functions. (2 marks)

Hormone: _____

Function: _____

_____

(ii) Provide an example of how plant producers can use the hormone to affect plant products. (3 marks)

_____

_____

_____

_____

(b) 2,4-D is a common herbicide that is a foliar spray. Name the hormone that 2,4-D is based on and explain its action on plant weeds. (3 marks)

Hormone: _____

Weed control use: _____

_____

_____

(c) 2,4-D is part of the Group I mode of action herbicides. Using a different example to Group I, define herbicide mode of action. (3 marks)

(d) Explain how herbicide modes of action are related to the development of herbicide resistant weeds. (3 marks)

See next page

Question 17 **(17 marks)**

Climate change has been associated with increases in atmospheric carbon dioxide (CO_2). An agronomist conducted a field trial under five domes with different levels of CO_2 to determine the optimal level of CO_2 for plant photosynthesis and hence crop growth. Current atmospheric CO_2 levels are about 380 parts per million (ppm). The following data were collected:

Level of CO_2 (ppm)	**Average photosynthesis rate ($\mu mol/m^2/s$)**
0	0
200	15
380	25
500	30
700	30

(a) (i) Graph the average photosynthesis rate for each of the different CO_2 levels using the data above on the grid below. (6 marks)

(ii) Indicate on the graph the control (reference) level of photosynthesis. (1 mark)

(If you need to have a second attempt at this graph item, the grid is repeated on the last page of this Question/Answer Booklet. Cancel the workings on this page.)

See next page

(b) What is your interpretation of the data from the field trial? (2 marks)

(c) The agronomist also measured sugar levels in the plants at the different CO_2 levels. Construct a hypothesis to show what you think will happen to plant sugar levels at different CO_2 concentrations. Justify your hypothesis. (4 marks)

Hypothesis:

Justification:

(d) Outline **two** strategies that you would recommend to ensure the trial was conducted reliably to minimise the possible sources of error. (4 marks)

One:

Two:

See next page

Question 18 **(14 marks)**

Salinity is a major environmental stress that affects both agricultural and natural systems. Salinity can be caused by agricultural practices, such as the replacement of the native perennial vegetation with annual crops and pastures, or from over-irrigating. The rehabilitation of land affected by salinity can be expensive and time consuming for plant producers.

(a) Explain how salinity caused by agriculture can affect the functioning and biodiversity of natural ecosystems. (4 marks)

(b) Explain how the decision to rehabilitate farmland affected by salinity is based on the following components of the Triple Bottom Line. (6 marks)

Social:

Economic:

Environmental:

(c) Define ‘intergenerational equity’ and explain how it could be affected by salinity.

(4 marks)

See next page

Question 19 **(14 marks)**

(a) Describe a new technology that could be utilised in a plant production enterprise. Outline a potential risk of implementing the new technology and prepare a risk management plan using the headings below. (11 marks)

New technology: _____

_____

_____

Potential risk: _____

_____

_____

Probability of risk: Low Moderate High
(Circle one)

Consequence: _____

_____

_____

Avoidance: _____

_____

_____

Mitigation: _____

_____

_____

(b) Explain how you could also use financial records to guide your decision on implementing the new technology. (3 marks)

_____

_____

_____

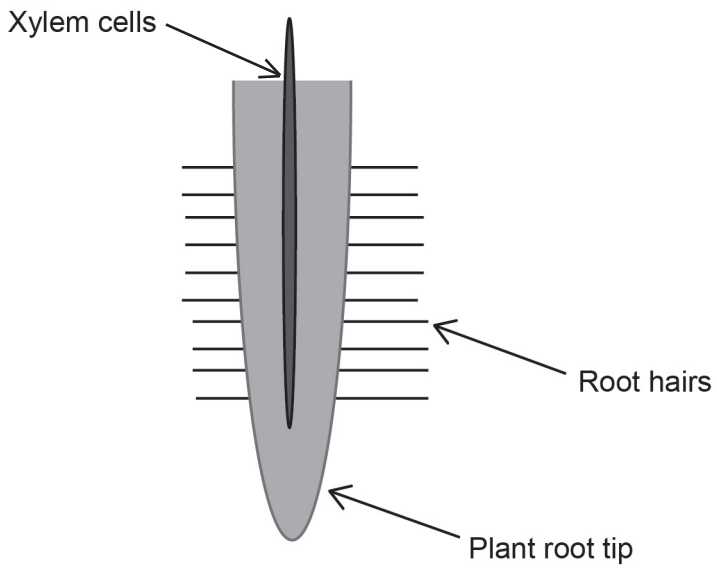
_____

_____

See next page

Question 20 **(7 marks)**

Below is a simplified diagram of a plant root section showing xylem cells that transport water and nutrients.



(a) Explain how nutrients from the soil are absorbed by plants and translocated to the shoot. (4 marks)

(b) Nutrient absorption from the soil relies on water uptake. Explain the process that drives water uptake by plants, including the plant structures involved. (3 marks)

See next page

Question 21 **(14 marks)**

A major goal of plant breeders is to utilise the genetic diversity of crop species.

(a) Define the term 'genetic diversity' in relation to crop plants and explain why it is important. (4 marks)

(b) Describe **two** sources of genetic diversity that would help to breed new cultivars. (6 marks)

One:

Two:

(c) Provide an example of a new plant cultivar that could be useful to a specific market, and explain how it could be developed using a source of genetic diversity. (4 marks)

Market:

Development of new cultivar using a source of genetic diversity:

See next page

Question 22 **(9 marks)**

A hydroponics company has asked you to undertake a glasshouse trial, which includes growing several varieties of vegetables with different amounts of nutrients in the growing media.

(a) Describe **two** observations or measurements you would take to examine the effect of nutrient levels on the vegetables. (4 marks)

One: _____

_____

_____

Two: _____

_____

_____

(b) The company has asked you to write a scientific report for your results. List **five** headings you would use in your report. (5 marks)

One: _____

Two: _____

Three: _____

Four: _____

Five: _____

End of Section Two

See next page

Section Three: Production practices **15% (30 Marks)**

This section contains **one (1)** question. You **must** answer this question. Write your answer in the spaces provided.

Use a plant production enterprise in which you participated during your course this year to answer Question 23.

Spare pages are included at the end of this booklet. They can be used for planning your responses and/or as additional space if required to continue an answer.

- Planning: If you use the spare pages for planning, indicate this clearly at the top of the page.
- Continuing an answer: If you need to use the space to continue an answer, indicate in the original answer space where the answer is continued, i.e. give the page number. Fill in the number of the question that you are continuing to answer at the top of the page.

Suggested working time: 30 minutes.

Question 23 **(30 marks)**

(a) (i) For a plant production enterprise that you studied in 2014, name the main product and describe a quality assurance (QA) program related to that product. (3 marks)

Enterprise: _____ (0 marks)

Product from enterprise: _____

Quality assurance program: _____

_____

_____

(ii) Provide an example of a farm practice that helps your product meet quality assurance criteria. Justify your response. (3 marks)

_____

_____

_____

_____

_____

(b) (i) Name a common soil type and explain the features that determine water availability in the soil. (3 marks)

(ii) Recommend a management strategy to improve water availability in the soil. (3 marks)

See next page

Question 23 (continued)

(c) (i) Choose a pest common to your enterprise and describe an integrated pest management (IPM) program. Outline an extended program (more than one season), using **three** control methods, in the table below. Indicate the timing of the control in relation to the production cycle for each season. (10 marks)

Pest: _____

Control method 1
Timing: Description of method:
Control method 2
Timing: Description of method:
Control method 3
Timing: Description of method:

See next page

(ii) Describe the advantages and disadvantages for **two** of the control methods you have given in part (c)(i). (8 marks)

End of Section Three

See next page

Section Four: Extended answer **20% (40 Marks)**

This section contains **three (3)** questions. You must answer **two (2)** questions. Write your answers on the lined pages provided following Question 26.

Spare pages are included at the end of this booklet. They can be used for planning your responses and/or as additional space if required to continue an answer.

- Planning: If you use the spare pages for planning, indicate this clearly at the top of the page.
- Continuing an answer: If you need to use the space to continue an answer, indicate in the original answer space where the answer is continued, i.e. give the page number. Fill in the number of the question that you are continuing to answer at the top of the page.

Suggested working time: 40 minutes.

Question 24 **(20 marks)**

Plant producers need to monitor and manage crop nutrition throughout the growing season, and even across multiple enterprises.

(a) For an enterprise of your choice, recommend a detailed plant nutrition program to maximise production. In your response, consider different plant growth stages, fertiliser type, fertiliser cost, soil type and application methods. (12 marks)

(b) Outline a strategy to monitor your enterprise to ensure plants are receiving the correct amount of fertiliser. Describe **two** possible consequences of applying the wrong amount of fertiliser. (8 marks)

Question 25 **(20 marks)**

(a) Outline the main characteristics of **two** different breeding technologies, and identify both a similarity and a difference between them. For each breeding technology, provide an example of a plant that is grown in Australia using this method. (10 marks)

(b) Using **one** of the breeding technologies outlined in part (a), describe in detail how it could be used to develop a new cultivar that is more adaptable to climate change. Include at least **four** steps in the breeding process and identify **two** traits that would help the cultivar to adapt to climate change. (10 marks)

See next page

Question 26 **(20 marks)**

The global economy and international trading have a large impact on the profitability of Australian producers.

(a) Define the term ‘comparative advantage’. Discuss **two** examples of how Australian producers have a comparative advantage over producers from another country and provide a reason for the advantage. For each example, propose a strategy to maintain Australia’s global competitiveness. (10 marks)

(b) Using examples, demonstrate **two** benefits that Australian quarantine laws provide for producers to maintain global competitiveness. Discuss a potential scenario in the global economy that could harm Australian producers and devise a strategy to minimise that harm. (10 marks)

End of questions

Question number: _____

Question number: _____

Question number: _____

Question number: _____

Spare answer page

Question number: _____

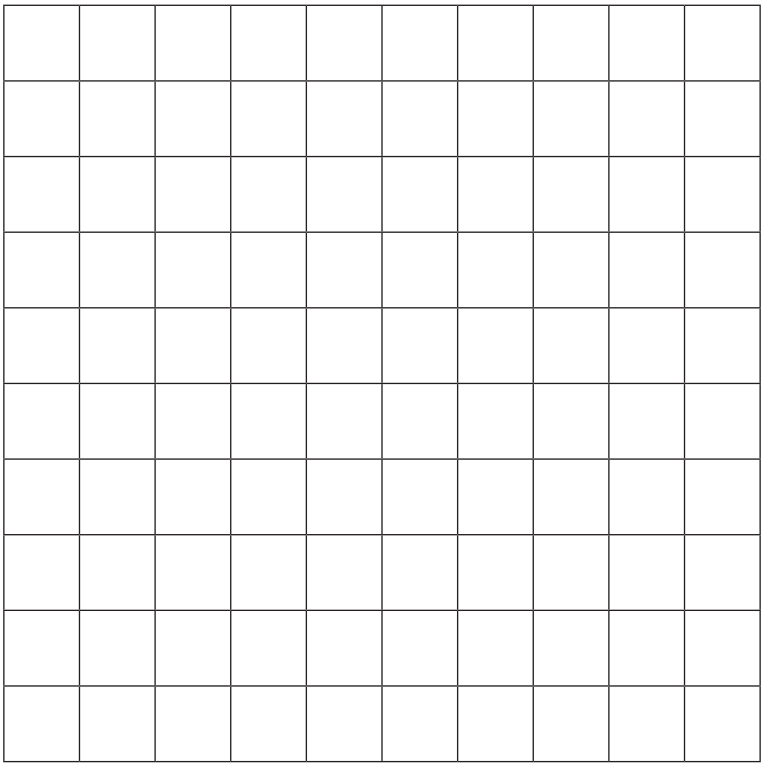
Spare answer page

Question number: _____

Spare answer page

Question number: _____

Question 17



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