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

ATAR course examination, 2017

Question/Answer booklet

PLANT PRODUCTION SYSTEMS

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: 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 this examination

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 material. If you have any unauthorised material with you, hand it to the supervisor **before** reading any further.

Ref: 17-069

Structure of this paper

Section	Number of questions available	Number of questions to be answered	Suggested working time (minutes)	Marks available	Percentage of examination
Section One Multiple-choice	20	20	30	20	20
Section Two Short answer	7	7	90	104	50
Section Three Extended answer	3	2	60	40	30
				Total	100

Instructions to candidates

1. The rules for the conduct of the Western Australian external examinations are detailed in the *Year 12 Information Handbook 2017*. 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 and Three: Write your answers in this Question/Answer booklet.

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

4. Supplementary pages for the use of planning/continuing your answer to a question have been provided at the end of this Question/Answer booklet. If you use these pages to continue an answer, indicate at the original answer where the answer is continued, i.e. give the page number.

See next page

Section One: Multiple-choice **20% (20 Marks)**

This section has **20** 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: 30 minutes.

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1. Tariffs on Australian goods help to maintain Australia's

   (a) competitiveness in global food markets.
   (b) clean, green image in overseas markets.
   (c) biosecurity against foreign pests.
   (d) reliance on government subsidies.

2. Market feedback is an essential part of which process?

   (a) production
   (b) planning
   (c) establishment
   (d) harvest

3. Keeping accurate records of pesticide use is a requirement of

   (a) pest management.
   (b) quality assurance.
   (c) intergenerational equity.
   (d) pest monitoring.

4. The Australian Quarantine and Inspection Service (AQIS) protects Australian markets by

   (a) identifying inferior goods.
   (b) inspecting the warranties of goods.
   (c) stopping cheap imports from entering the country.
   (d) preventing the entry of pests and diseases.

5. Changing from a chemical based to an organic based production system can be driven by

   (a) a need to be more efficient.
   (b) higher crop yields.
   (c) changing consumer needs.
   (d) the need to reduce labour costs.

See next page

6. The quality of perishable plant products during handling and transport has been improved by

   (a) more roads.
   (b) refrigeration.
   (c) faster trucks.
   (d) locating farms close to markets.

7. The **most** effective way of estimating the profitability of a farming business is a

   (a) cashflow budget.
   (b) partial budget.
   (c) gross margin budget.
   (d) development budget.

8. Farmers carry out duty of care in the workplace as part of

   (a) quality assurance.
   (b) intergenerational equity.
   (c) risk management.
   (d) sustainable production.

9. Which practice increases the chances of developing pesticide resistance?

   (a) rotation of pesticides with different modes of action
   (b) knowing pest life cycles and applying chemicals at critical times
   (c) integrating chemical applications with other control methods
   (d) using a highly successful pesticide continuously

10. In a natural ecosystem, which category of organisms is mostly responsible for nutrient recycling?

    (a) Rhizobia
    (b) Bacteria
    (c) Insects
    (d) Viruses

11. In most ecosystems, the main source of energy is the

    (a) sun.
    (b) producers.
    (c) autotrophs.
    (d) heterotrophs.

See next page

12. The use of hormones as a weed control is effective when

(a) small amounts of an animal hormone are used.
(b) small amounts of a plant hormone are used.
(c) excessive amounts of animal hormone are used.
(d) excessive amounts of plant hormone are used.

13. Which one of the following factors does **not** contribute to the exploitation of an agricultural ecosystem?

(a) higher levels of education for farmers
(b) economic pressures to increase production
(c) demand for products of specific standards
(d) development of modern technology to increase production

14. Fruit can be ripened by using which plant hormone?

(a) ethylene
(b) cytokinin
(c) gibberellin
(d) auxin

15. When an unusual plant pest or disease is found on your property, which biosecurity precaution should you take?

(a) Mark the site and allow neighbours to access the site to see the damage.
(b) Take a sample of the affected plant and send it to the Department of Agriculture and Food.
(c) Restrict the movement of people, stock and equipment near the affected area.
(d) Remove the plant produce from the affected area and dispose of it at the local rubbish tip.

16. Which statement is the **best** example of an hypothesis?

(a) Nitrogen is needed by all plants for early growth.
(b) An increase in nitrogen will increase growth rates in plants.
(c) Growth of plants is dependent on nitrogen.
(d) Nitrogen may increase the yield in plants if it is applied correctly.

17. A residual herbicide can **best** be described as a chemical that

(a) remains active in the soil for an extended period and can act on successive weed germinations.
(b) has little or no soil activity and is deactivated quickly in the soil by bacteria.
(c) has limited movement within the plant, so complete coverage of the target weed is critical.
(d) once applied to the weed, moves to the site of action via transport mechanisms within the plant.

See next page

18. Which of the following fertiliser applications may negatively impact the environment?

    (a) topdressing granular fertiliser to a hay crop on a windy day
    (b) spraying liquid fertiliser onto a crop soon after rainfall
    (c) applying superphosphate on sandy soils next to waterways
    (d) spreading manure on a closely grazed paddock

19. Seed banks are an important source of genetic diversity from plants around the world. Which statement about seed banks is **incorrect**.

    (a) The seeds are preserved to conserve potentially valuable genotype adaptations.
    (b) Seeds are stored at room temperature to prevent them from germinating.
    (c) Germination tests are carried out to assess the viability of the material.
    (d) Plant breeders are able to access the banks for their breeding programs.

20. A natural ecosystem can be described as the relationship between the

    (a) physical part of the environment and climate.
    (b) living part of the environment and soil type.
    (c) human population, the environment and small animals.
    (d) interacting community of organisms and their physical environment.

End of Section One

See next page

Section Two: Short answer **50% (104 Marks)**

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

Supplementary pages for the use of planning/continuing your answer to a question have been provided at the end of this Question/Answer booklet. If you use these pages to continue an answer, indicate at the original answer where the answer is continued, i.e. give the page number.

Suggested working time: 90 minutes.

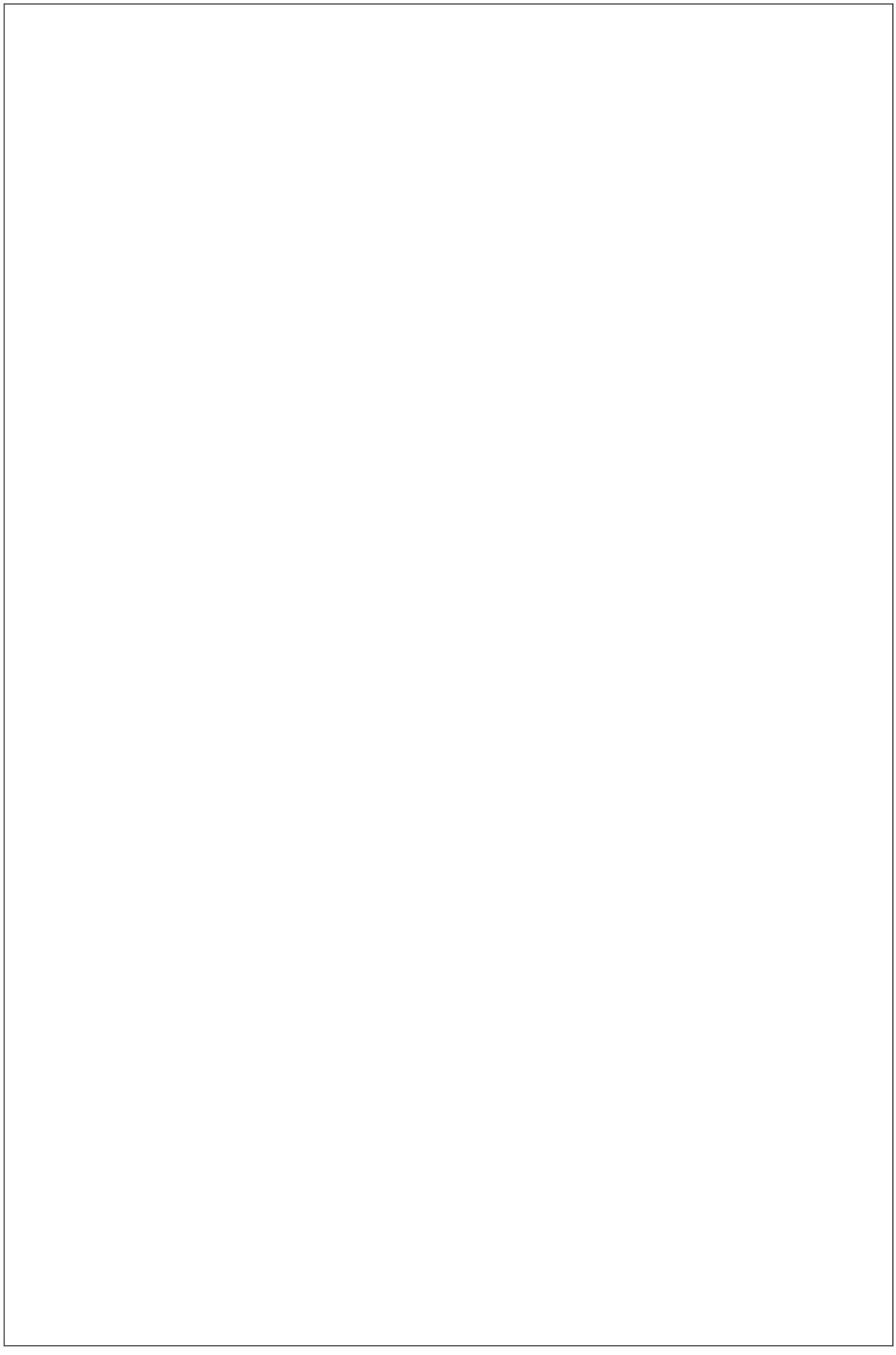
Question 21 **(15 marks)**

The presence of pests in plant production systems can affect the quality and quantity of marketed products and decrease overall profits.

(a) Define the term ‘pesticide resistance’. (2 marks)

Question 21 (continued)

(b) Draw and label a diagram in the space below to represent the expected population growth curve of a pest if left untreated. (3 marks)



See next page

(c) Define Economic Injury Level (EIL) and Economic Threshold (ET). Draw and label these lines on the diagram in part (b). (6 marks)

(d) List **two** practices that can decrease the chances of pesticide resistance occurring and state how each practice is carried out. (4 marks)

See next page

Question 22 **(17 marks)**

Budgets are used for planning purposes. Barley producers have the opportunity to grow a higher valued malting grade rather than feed grade. The table below compares the gross margins for producing malting barley and feed barley in Western Australia.

Performance data	**Malting barley**	**Feed barley**
Average Yield (tonnes/ha)	2.5	3.2
Average Price ($/tonne)	300	250
Income ($/ha)	**A**	**B**
Costs ($/ha)		
Seed	30	25
Fertiliser	25	25
Herbicide	30	30
Fuel	15	15
Labour	60	60
Fungicide	8	0
Insecticide	10	0
Levies	15	12
Total Costs ($/ha)	**193**	**167**
Gross Margin $/ha	**C**	**D**

(a) Calculate the income and the gross margin for each crop and state which crop is the more profitable option. (5 marks)

Income of malting barley A: _____

Income of feed barley B: _____

Gross margin of malting barley C: _____

Gross margin of feed barley D: _____

More profitable option: _____

See next page

Just before seeding, the forecast is for an above-average season in Western Australia. This will increase the average yields by 1 tonne/hectare and a predicted worldwide shortage of malting barley will lift the price by $50/tonne.

(b) Recalculate the gross margins and explain how this information might influence your decision to grow malting or feed barley. Show all workings. (4 marks)

A new herbicide for improving weed control in cereal crops becomes available. It will increase average yield by 10% for an extra cost of $75/hectare.

(c) Using your calculations in part (a), how will this new information guide your decision to grow malting or feed barley? Show all workings. (4 marks)

See next page

Question 22 (continued)

(d) Describe a new technology for plant production and how it can increase the profitability of a plant enterprise. (4 marks)

See next page

Question 23 **(15 marks)**

There are many pest control methods available to agricultural producers but some are more effective than others.

A trial will take place in a 50 hectare pasture paddock that has annual ryegrass throughout. The paddock will be sown to canola in the next rotation. Trial treatments will consist of cultivation and chemical knockdown.

(a) Explain why replication and randomisation are important in this trial. (6 marks)

Experimental component	Importance in trial
Replication	
Randomisation	

(b) Describe **one** aspect of the trial that could result in possible bias. (2 marks)

See next page

Question 23 (continued)

Following the trial the results were inconclusive.

(c) Use the headings of aim, treatments and method to outline a future investigation that could improve the farmers understanding of ryegrass control.

(i) Aim: (2 marks)

(ii) Treatments: (2 marks)

(iii) Method: (3 marks)

See next page

Question 24 **(14 marks)**

Australian plant products have an advantage in the global marketplace.

(a) Describe how quarantine inspection protects Australian plant producers. (2 marks)

(b) Describe how comparative advantage helps Australian plant producers maintain their global competitiveness? (2 marks)

(c) (i) Select a plant product and state its major export market destination. (2 marks)

Product: _____

Destination: _____

(ii) Describe **two** strategies producers use to ensure that they remain competitive in the export market destination selected in part (c)(i). (4 marks)

See next page

Question 24 (continued)

(c) (iii) Identify a developing trend in consumer demand for the plant product in part (c)(i). Explain how producers can adapt their production systems to take advantage of this trend. (4 marks)

See next page

Question 25 **(13 marks)**

Photosynthesis and transpiration are processes that play an important role in plants.

(a) (i) Describe how a plant uses the end product of photosynthesis. (2 marks)

(ii) State **two** environmental conditions that affect the rate of photosynthesis and explain **one** method of manipulating the photosynthetic process artificially. (4 marks)

(b) State

(i) one role transpiration plays in a plant. (1 mark)

(ii) one plant structure that is involved in controlling transpiration. (1 mark)

(iii) one environmental factor that reduces plant transpiration. (1 mark)

See next page

Question 25 (continued)

(c) (i) Describe how soluble plant nutrients are absorbed out of the soil into plant roots. (2 marks)

(ii) Describe nutrient movement in phloem vessels of plants. (2 marks)

See next page

Question 26 **(15 marks)**

Water and soil management are critical to the success of a plant production system.

(a) (i) State **two** methods that can be used to increase the availability of water to a growing crop. (2 marks)

(ii) Describe the difference between field capacity and available water. (4 marks)

(iii) Outline how a difference in pore space in the soil can change water availability to a plant. (2 marks)

See next page

Question 26 (continued)

(b) List **two** production records a farmer should maintain to achieve good nutrient management. (2 marks)

_____

_____

(c) For a plant enterprise you have studied, state the decision making involved in selecting a nutrient (fertiliser) that will be applied to a crop of your choice in light and sandy soil. Complete the table below. (5 marks)

Nutrient applied: _____ (0 marks)

Criteria	State the critical information you require when selecting the nutrient in the following soil type
Soil type	Light and sandy
Crop type	
Stage of crop growth at application	
Cost	
Availability	
Application Method	

See next page

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See next page

Question 27 **(15 marks)**

A research company tested whether canola emergence from deep sowing could be improved by using larger seed.

Table 1: Canola yield (kg/ha)

Seed size	Yield kg/ha		
	15 mm deep	30 mm deep	60 mm deep
Canola < 1.65 mm	1300	1200	350
Canola > 1.65 and < 1.8 mm	1360	1300	350
Canola > 1.8 and < 2 mm	1440	1300	500
Canola > 2 mm	1500	1400	600
Average	**A**	**B**	**C**

(a) Calculate the mean canola yield based on sowing depth. (3 marks)

A: _____

B: _____

C: _____

(b) Using the information in part (a), construct a graph showing the relationship between canola yield and sowing depth. (6 marks)

A spare grid is provided at the end of the question/answer booklet. If you need to use it, cross out this attempt.

See next page

Question 27 (continued)

(c) Using the information in the graph and table, discuss the impact on canola yield based on sowing depth and seed size. (4 marks)

(d) Describe the critical environmental factor that should be considered when deciding on sowing depth. (2 marks)

End of Section Two

Section Three: Extended answer **30% (40 Marks)**

This section contains **three (3)** questions. You **must** answer **two (2)** questions: the compulsory question (Question 28) and **one (1)** of the other questions (Question 29 or Question 30). Write your answers to Question 28 in the spaces provided. Write your answers to Question 29 or 30 on the lined pages provided following Question 30.

Supplementary pages for the use of planning/continuing your answer to a question have been provided at the end of this Question/Answer booklet. If you use these pages to continue an answer, indicate at the original answer where the answer is continued, i.e. give the page number.

Suggested working time: 60 minutes.

Question 28 **(20 marks)**

Plant production enterprise: _____ (0 marks)

Marketed product: _____ (0 marks)

(a) (i) Identify the Quality Assurance (QA) program used for your marketed product. (1 mark)

_____

(ii) Explain **one** day-to-day operational process that is in place and how it maintains the QA status identified in part (a)(i). (3 marks)

_____

_____

_____

_____

_____

_____

(iii) Identify an aspect of product quality that will vary as a result of inadequate plant nutrition. Describe a strategy that will minimise the effect on your marketed product. (3 marks)

_____

_____

_____

_____

_____

_____

See next page

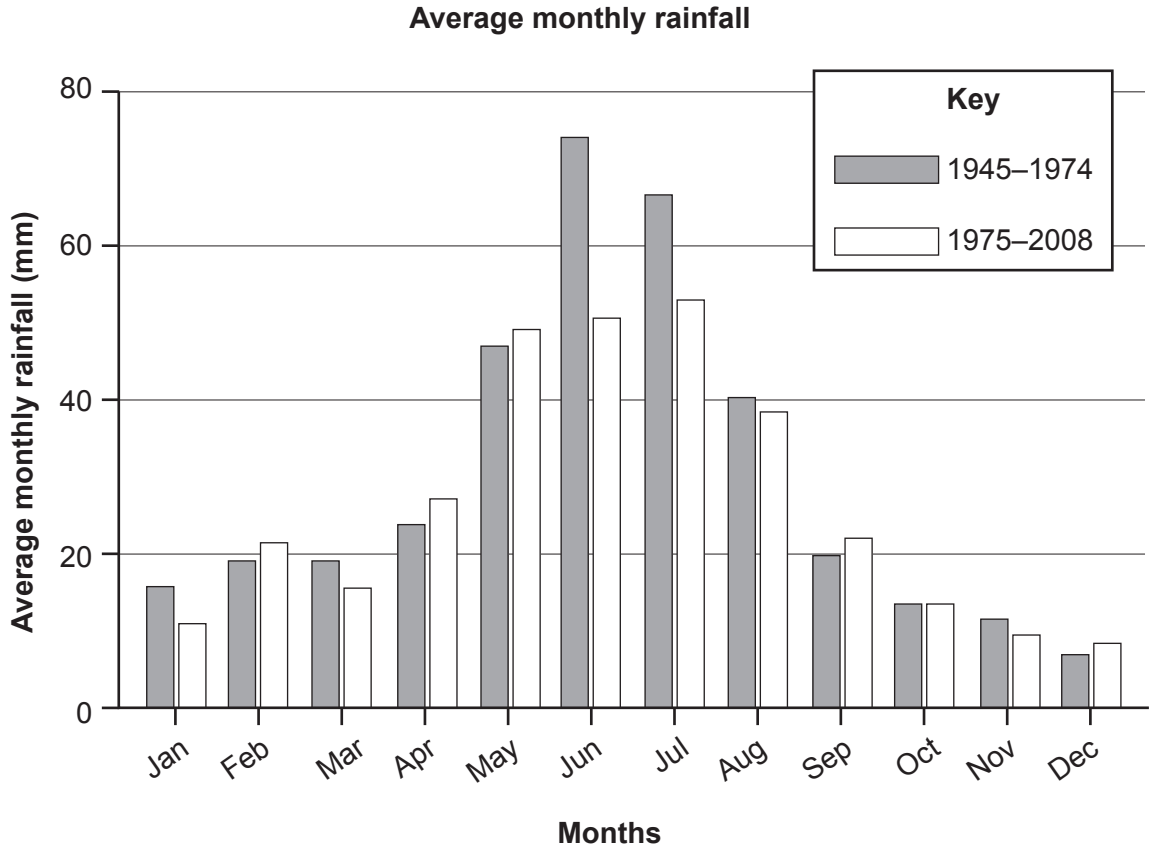
Question 28 (continued)

(a) (iv) Describe **two** ways in which you might change your plant production methods if the cost of fertiliser rises. (4 marks)

(b) Variety development assists producers to maintain a competitive edge. Describe **two** characteristics of a variety used in your nominated enterprise that will improve the quality of the marketable product. (4 marks)

See next page

The following graph provides rainfall information for the region in which your plant production enterprise is located.



(c) (i) State the effect on the financial return to your plant production enterprise on the basis of the information in the graph above. (1 mark)

(ii) If the trend in the graph continues for the next 30 years (2009–2039) describe how you might manage this risk using **one** avoidance and **one** mitigation strategy. (4 marks)

See next page

Question 29 **(20 marks)**

Changing environments have an impact on the sustainability of a plant enterprise system.

(a) Select **one** environmental factor from the list below and explain how tolerance to that factor could be bred into a cultivar by using **one** conventional breeding technique and **one** genetic engineering technique. (8 marks)

Environmental factors:
- drought
- salinity
- waterlogging
- frost.

(b) Select **two** environmental factors from the list below and describe the strategies a farmer could put in place to remain profitable in the short term and sustainable in the long term. (12 marks)

Environmental factors:
- salinity
- waterlogging
- frost
- low pH
- water repellent soil
- wind erosion
- water erosion.

or

Question 30 **(20 marks)**

Climate variability has always posed a risk for plant producers. In recent times, climate change caused by human activity is presenting new challenges to plant producers.

(a) Describe the predicted climate changes that may affect the south-west of Western Australia and discuss **three** specific risks that plant producers face as a result of climate change. (11 marks)

(b) For **one** of the risks identified in part (a), describe how the triple bottom line could be managed by farmers in an attempt to maintain sustainability. (9 marks)

End of questions

Question number: _____

Question number: _____

Question number: _____

Question number: _____

Question number: _____

Supplementary page

Question number: _____

Spare grid

ACKNOWLEDGEMENTS

Question 17(a–d) Adapted from: Department of Agriculture and Food (DAFWA). (n.d.). *Herbicides*. Retrieved January, 2017, from https://www.agric.wa.gov.au/herbicides/herbicides?nopaging=1

Question 28(c) Graph adapted from: Pannell, D. J. (2012). *229 – Past climate change and wheat yields in Western Australia* (Fig. 1) [Blog post]. Retrieved May, 2017, from www.pannelldiscussions.net/2012/12/229-past-climate-change-and-wheat-yields-in-western-australia/

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