



ATAR course examination, 2019

Question/Answer booklet

PLANT PRODUCTION SYSTEMS

Please place your student identification label in this box

WA student number: In figures

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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.

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	106	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 2019*. 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. Do not use erasable or gel pens. 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 planning/continuing your answers to questions are 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.

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. Do not use erasable or gel pens. 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.

1. In what conditions will plants transpire at the fastest rate?
 - (a) low humidity/low soil water
 - (b) low humidity/high soil water
 - (c) high humidity/low soil water
 - (d) high humidity/high soil water

2. A common use of synthetic auxin is as a
 - (a) dormancy breaker.
 - (b) fertiliser.
 - (c) seed treatment.
 - (d) herbicide.

Questions 3 and 4 relate to the table below.

Water-holding capacity of soil (mm of water per metre of soil depth)

	Soil type A	Soil type B	Soil type C
Field capacity of the soil	150	280	410
Permanent wilting point	80	150	250

3. The amount of water available for each of the soil types is
 - (a) A = -70, B = -130 and C = -160.
 - (b) A = -230, B = -430 and C = -660.
 - (c) A = 70, B = 130 and C = 160.
 - (d) A = 230, B = 430 and C = 660.

4. Each soil has a different water availability because each soil has a different
 - (a) texture.
 - (b) fertility.
 - (c) pH.
 - (d) microbial population.

See next page

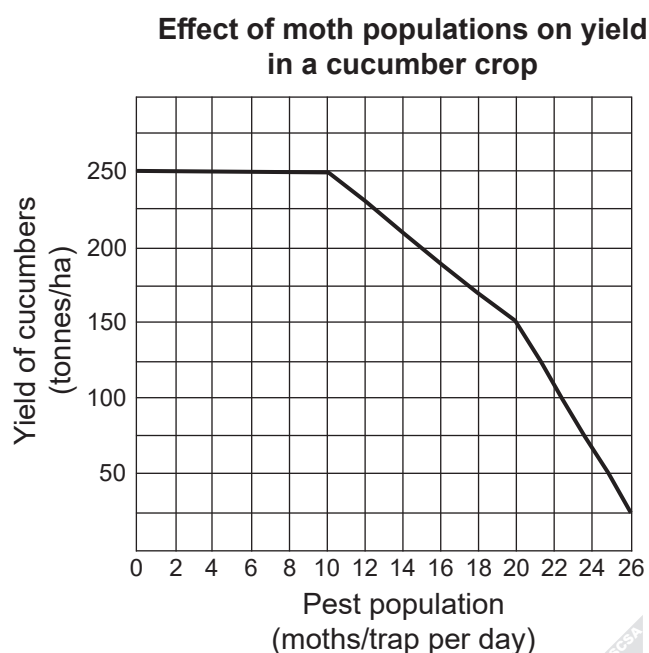
5. To improve soil water retention, producers can
- (a) cultivate.
 - (b) mulch.
 - (c) irrigate.
 - (d) spread lime.
6. Which of the following would help to maintain intergenerational equity?
- (a) reducing debt by selling off land
 - (b) dividing assets among children
 - (c) clearing more land to increase holdings
 - (d) adopting sustainable farming practices
7. The triple bottom line refers to
- (a) intergenerational equity factors.
 - (b) environmental sustainability factors.
 - (c) social, economic and environmental factors.
 - (d) social, economic and biosecurity factors.
8. The outcome of the risk mitigation process is to
- (a) apply solutions to reduce risk.
 - (b) identify potential risks.
 - (c) identify consequences of risk.
 - (d) assess risk probability.
9. To increase the likelihood of obtaining a statistically-significant result, the design of an experiment should include
- (a) uniformity and repetition.
 - (b) randomisation and replication.
 - (c) variation and significance.
 - (d) variation and a control.
10. Which factor has the **least** impact on the ability of a country such as Australia to establish a comparative advantage in a particular product?
- (a) international exchange rate
 - (b) cost of labour
 - (c) availability of land
 - (d) favourable climatic conditions

11. In the calculation of gross margins, which is correct? Gross margin =
- (a) Fixed costs – Variable costs
 - (b) Income – Variable costs
 - (c) Income + Fixed costs
 - (d) Variable costs + Fixed costs
12. Which statement **best** describes the requirements of 'duty of care' in the workplace?
- (a) Duty of care does not apply to everyone.
 - (b) A safety induction is all that is required.
 - (c) All individuals in the workplace have a duty of care.
 - (d) The employer has sole responsibility for a safe workplace.
13. The Australian Government may apply a tariff on a plant import to
- (a) protect importers against price fluctuations in the marketplace.
 - (b) make imports less desirable to consumers because of price.
 - (c) increase import trade by subsidising local producers.
 - (d) improve the international competitiveness of Australian producers.
14. Inaccurate reporting of trial results because of a researcher's opinion or belief is commonly known as
- (a) experimental bias.
 - (b) replication fault.
 - (c) standard error.
 - (d) variable influence.
15. Which of the following would have a slowing effect on climate change?
- (a) replace cropping with grazing livestock
 - (b) increase crop area by clearing native vegetation
 - (c) grow short season cereal crops
 - (d) grow more legumes in crop rotations
16. A likely impact of climate change for southern Australia is
- (a) fewer cyclones, more winter rain.
 - (b) lower winter temperatures, more summer rain.
 - (c) more hot weather, less winter rain.
 - (d) less hot weather, more summer rain.

17. Which market information is of **most** value to a producer in planning future production practices?
- (a) product price today
 - (b) quantity of product in the market
 - (c) number of buyers in the market
 - (d) product specifications

Questions 18,19 and 20 refer to the graph below.

A cucumber producer has a number of strategies available to control a pest in the crop. The following information has been provided by an agronomist.



18. Which of the following statements is a valid conclusion based on the experimental data presented in the graph?
- (a) When yield is low, the pest population is low.
 - (b) When the pest population is high, the yield is high.
 - (c) Over time, the pest population in the crop increases.
 - (d) As moth numbers increase, the crop yield decreases.
19. If the break-even yield for cucumbers is 225 tonnes/ha, the economic threshold for the control of the pest population is closest to which of the following?
- (a) 8 moths/trap per day
 - (b) 10 moths/trap per day
 - (c) 12 moths/trap per day
 - (d) 14 moths/trap per day

20. If a pest population of 10 moths/trap per day has no effect on yield, which production factor influences total pest control?
- (a) meeting consumer preference for a damage-free product
 - (b) reducing pest resistance to chemicals
 - (c) ensuring sustainable practices
 - (d) maximising income by eliminating losses

End of Section One

See next page

Section Two: Short answer**50% (106 Marks)**

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

Supplementary pages for planning/continuing your answers to questions are 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.

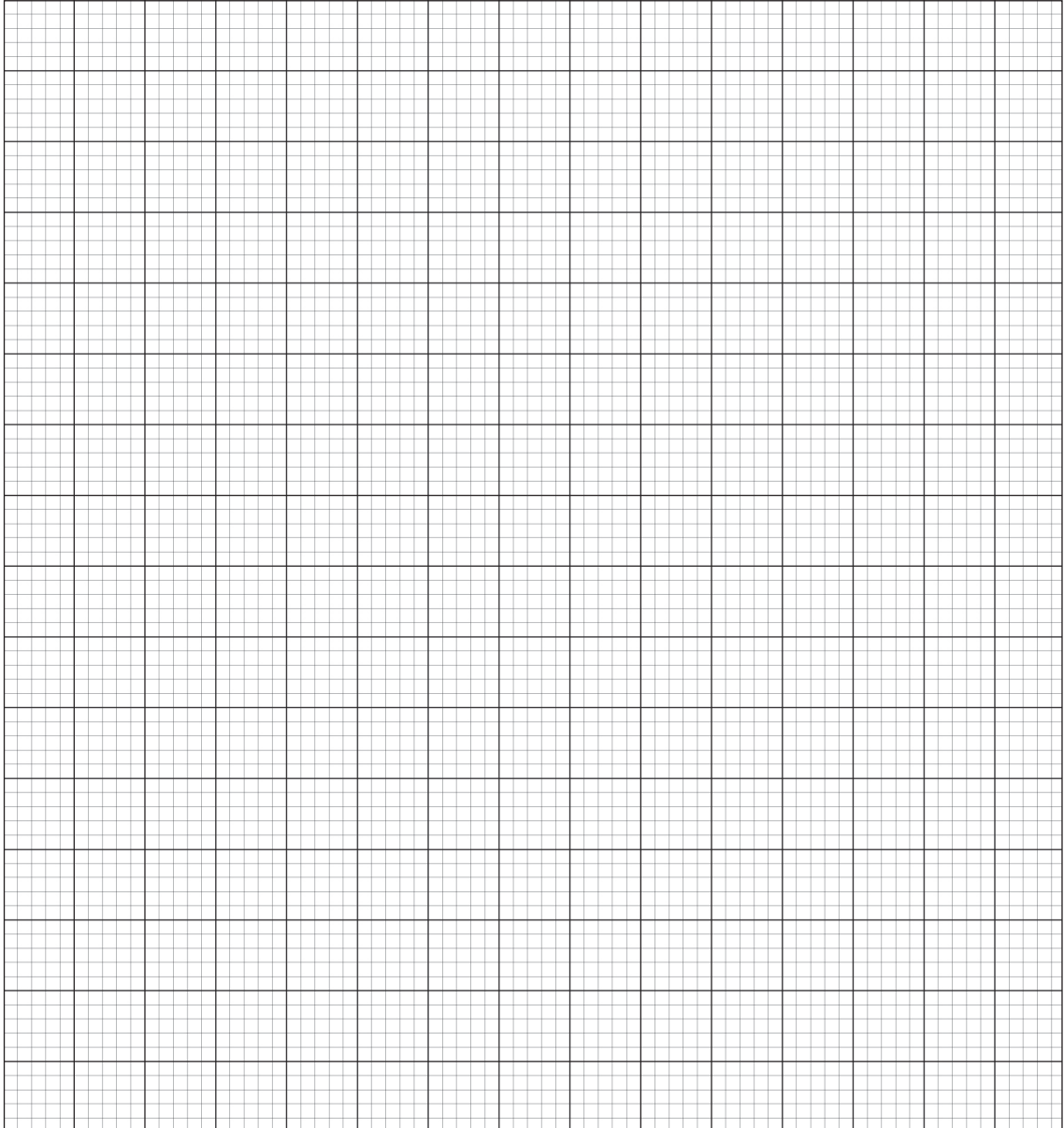
Question 21**(18 marks)**

There has been an outbreak of the highly-damaging Russian wheat aphid in South Australia. Below is a summary of observations collected over a one-month period.

Days	Average number of aphids/ha (000s)
0	10
5	30
10	110
15	120
20	150
25	160
30	160

See next page

- (a) Use the grid below to draw a line graph of the average number of aphids per hectare observed over time. (5 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 21 (continued)

(b) (i) Define economic injury level (EIL). (2 marks)

(ii) Using the following parameters, calculate the EIL for aphids in wheat.

- damage caused by each 10 000 aphids/ha reduces the average wheat yield by 1%
- wheat is valued at \$300/tonne
- average wheat yield is 2 tonne/ha
- cost of aphid treatment is \$54/ha.

Show your workings. (2 marks)

(iii) Place an **X** on the graph on page 9 to indicate the calculated EIL. (1 mark)

(iv) State what would happen to the EIL if the cost of controlling the aphids increased by \$15/ha. (1 mark)

As aphid control becomes more expensive, farmers are advised to grow an alternative crop.

	Current	Alternative
Income	Wheat	Chia
Average yield (t/ha)	2.0	4.0
Forecast price (\$/t)	300	200
Total income (\$/ha)		

Variable costs	\$/ha	\$/ha
Seed	50	150
Machinery maintenance	150	150
Fertiliser	100	200
Pest control	70	0
Casual labour	100	100
Delivery/storage	50	110
Total variable costs		
Gross margin (\$/ha)	A	B

- (c) Complete the gross margins above for wheat and chia. (2 marks)

A: _____

B: _____

The 10 year average price for wheat is \$250 per tonne, while for chia it is \$100 per tonne.

- (d) Outline **one** risk to the farmer's long-term economic sustainability if the advice to grow the alternative crop is followed. (2 marks)

- (e) Describe **one** new technology that could reduce the cost of crop production. (3 marks)

Question 22

(14 marks)

Utilising the genetic diversity of crop species is a major goal for plant breeders.

- (a) Outline **two** sources of genetic diversity that could assist in the breeding of new cultivars. (4 marks)

One: _____

Two: _____

- (b) (i) List **one** example of a plant species or cultivar recently adopted in Western Australia and state how it could meet changing consumer trends. (2 marks)

- (ii) State **four** steps used to develop a cultivar by crossbreeding. (4 marks)

One: _____

Two: _____

Three: _____

Four: _____

- (c) Outline **two** ethical issues related to genetically modified organism (GMO) food crops. (4 marks)

One: _____

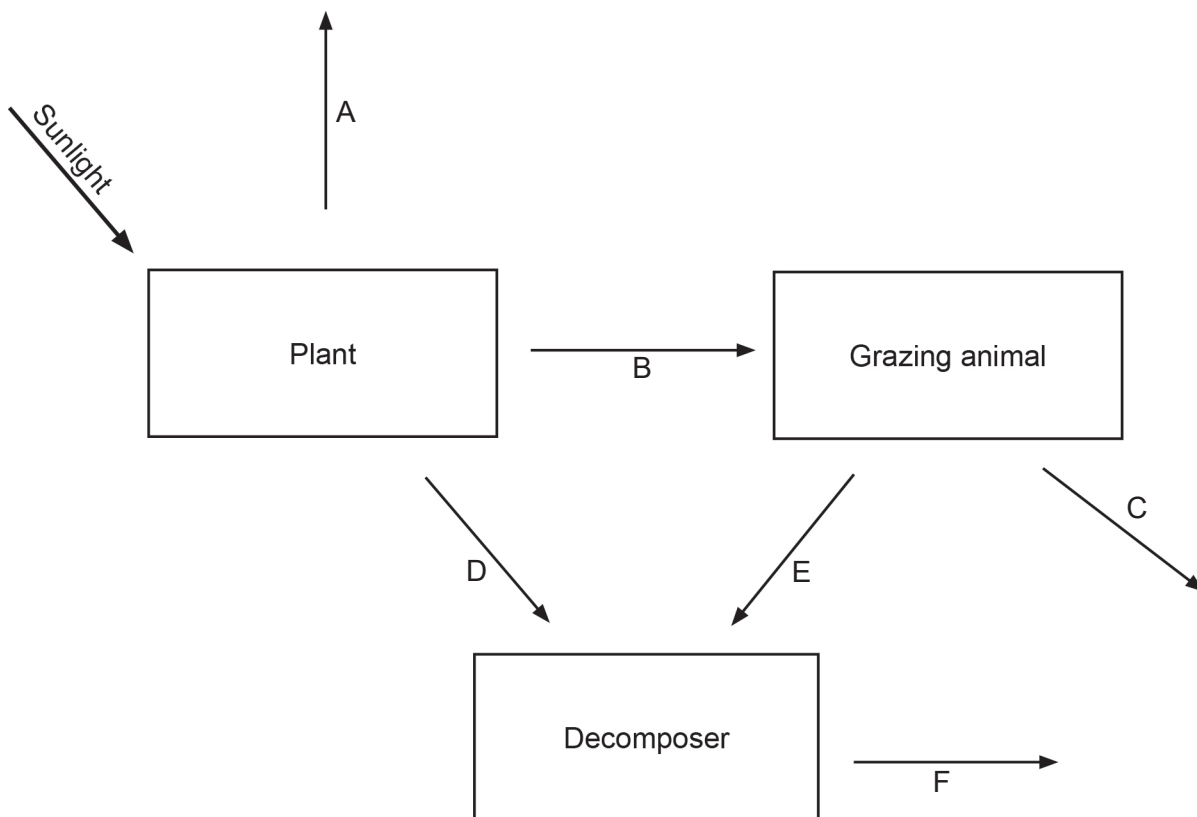
Two: _____

Question 23

(15 marks)

In the diagram below, the letters A–F indicate energy flows within an agricultural ecosystem.

Example: Sunlight to plants for photosynthesis.



- (a) Outline **two** of the energy flows (including whether they are gains or losses) for the agricultural ecosystem shown in the diagram above. (4 marks)

One: _____

Two: _____

- (b) Identify **one** negative impact of climate change on a plant production system and describe how it could affect the flow of energy through that system. (4 marks)

- (c) Outline **one** practical application you could implement in a plant production system to minimise the impact identified in part (b). (2 marks)

- (d) (i) Outline **one** impact of reduced biodiversity in a plant production system. (2 marks)

- (ii) Describe **one** effective strategy for conserving biodiversity in a plant production system. (3 marks)

Question 24

(14 marks)

Transpiration is necessary for plant growth.

- (a) State what happens to water during transpiration. (1 mark)

- (b) (i) Outline what would happen to the rate of transpiration if the temperature increased. (2 marks)

- (ii) Write an hypothesis that would test part (b)(i). (1 mark)

- (c) Propose how you would test the hypothesis in part (b)(ii), taking into consideration the four aspects of experimental design. (8 marks)

At the end of the experiment, the data in one treatment was analysed and the standard deviation was calculated.

Data analysis	Rate of transpiration (ml/hr)
Mean	6.8
Standard deviation	2.85

- (d) Outline what the standard deviation reveals about the data in the table above. (2 marks)

Question 25

(16 marks)

The manipulation of plant processes contributes to improvements in plant production systems.

- (a) (i) State the **two** net products of photosynthesis. (2 marks)

One: _____

Two: _____

- (ii) List **two** limiting environmental factors that affect the rate of photosynthesis. (2 marks)

One: _____

Two: _____

- (iii) Describe **one** effect that climate change will have on the rate of photosynthesis. (3 marks)

- (b) (i) Outline **one** mechanism that plants use to absorb nutrients from the soil. (2 marks)

- (ii) Describe the purpose of translocation in a plant. (3 marks)

- (iii) Identify a plant hormone that inhibits growth and speeds up the ripening process. (1 mark)

- (iv) Describe a practical application for the plant hormone identified in part (b)(iii). (3 marks)

Question 26

(17 marks)

Fertile soil is fundamental to the growth of healthy plants. Soil test results from a paddock that was used for growing oats are shown in the table below.

Nutrients removed from a 34 hectare paddock used for growing oats

Crop	Paddock area – 34 ha	Nutrient removed (kg/tonne)		
		Nitrogen	Phosphorus	Potassium
Oats – grain	17 ha	16	3	4
Oats – hay	17 ha	20	2	25

- (a) (i) Outline **one** critical factor that will have to be addressed in this paddock before a crop can be grown next year. (2 marks)

The producer has decided to grow an oat hay crop over the entire paddock and has a choice of three fertilisers, as shown in the table below.

Fertiliser	% nitrogen in fertiliser	Fertiliser cost \$/tonne	Cost of nitrogen/kilogram fertiliser
Allfert	5	\$200	\$4.00
Betafert	15	\$375	\$2.50
Centrafert	22	\$660	\$3.00

- (ii) Which of the fertilisers shown above will provide the required nitrogen at the lowest cost? (1 mark)

- (iii) State the stage in the crop's growth at which the application of nitrogen fertiliser would have the greatest effect on the potential yield. (1 mark)

- (iv) Other than fertiliser cost, outline **one** factor the producer should consider when selecting their fertiliser. (2 marks)

- (v) Outline how the producer can determine which rate of fertiliser will maximise crop yields. (2 marks)

- (b) Describe **two** strategies that can be implemented to reduce the negative impact of fertiliser on the environment. (6 marks)

One: _____

Two: _____

Question 26 (continued)

- (c) Heavy rainfall has been forecast pre-seeding. Describe **one** strategy that will enable soil water to be managed so that the potential yield of a crop is maximised. (3 marks)

Question 27

(12 marks)

With the continued evolution of pesticide resistance, a range of pest controls are required.

- (a) Clarify the relationship between mode of action and pest control. (2 marks)

- (b) Describe **two** on-farm factors that could lead to pesticide resistance. (6 marks)

One: _____

Two: _____

Question 27 (continued)

- (c) (i) Identify a strategy in a plant production system that reduces the reliance on pesticides. (1 mark)

- (ii) Describe how the strategy in part (c)(i) could affect the productivity of a plant production system. (3 marks)

End of Section Two

See next page

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

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

Supplementary pages for planning/continuing your answers to questions are 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)**

The economic sustainability of a plant production system is underpinned by a sound knowledge of the product.

- (a) For a plant production system you are familiar with, name the main product, its main market destination and Australia's main competitor. (3 marks)

Main product: _____

Main market destination: _____

Australia's main competitor: _____

Note: the remaining questions should be answered using the product listed in part (a).

- (b) (i) Describe a quality assurance (QA) program related to the product. (3 marks)

Question 28(b) (continued)

- (ii) Identify **two** on-farm criteria used in the QA program and outline how they enable the producer to maintain product quality. (6 marks)

One: _____

Two: _____

- (c) Name **two** variations in product quality caused by adverse weather conditions and explain a strategy to mitigate each of them. (8 marks)

One: _____

Two: _____

Question 29

(20 marks)

Australian agriculture relies heavily on export markets for its prosperity.

- (a) Describe the factors that affect the ability of the Australian agricultural plant industry to maintain both its competitiveness and access to global markets. Explain the effective strategies used to address **one** of these factors. (10 marks)
- (b) Identify a disease/pest that would affect the sustainability of Australia's plant production systems and describe the consequences of an outbreak. Consider **two** management strategies that would need to be put in place, **one** on-farm and **one** at a national level, to combat an outbreak of the stated disease/pest. (10 marks)

or

Question 30

(20 marks)

Plant production viability relies on accurate production data.

Yields of four canola cultivars			
Cultivar	Average yield 2018	Average yield over 5 years (2014–2018)	Number of sites tested
A	2.4	2.6	14
B	2.2	2.4	39
C	2.0	2.2	21
D*	5.4	NA	4

NA – only one year's data were collected.

* Genetically modified organism (GMO).

- (a) Describe how a producer might assess the data in the yield table above. Analyse the future role of Cultivar D by applying the triple bottom line factors. (10 marks)
- (b) Explain why new cultivars of all crops need to be developed to meet short-term production goals and ensure the long-term sustainability of resources. (10 marks)

End of questions

Spare grid



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