

STUDENT NUMBER  Letter

# AGRICULTURAL AND HORTICULTURAL STUDIES

## Written examination

Thursday 3 November 2022

Reading time: 9.00 am to 9.15 am (15 minutes)

Writing time: 9.15 am to 10.45 am (1 hour 30 minutes)

### QUESTION AND ANSWER BOOK

#### Structure of book

<i>Number of questions</i>	<i>Number of questions to be answered</i>	<i>Number of marks</i>
13	13	100

- Students are permitted to bring into the examination room: pens, pencils, highlighters, erasers, sharpeners and rulers.
- Students are NOT permitted to bring into the examination room: blank sheets of paper and/or correction fluid/tape.
- No calculator is allowed in this examination.

#### Materials supplied

- Question and answer book of 19 pages

#### Instructions

- Write your **student number** in the space provided above on this page.
- All written responses must be in English.

**Students are NOT permitted to bring mobile phones and/or any other unauthorised electronic devices into the examination room.**

**Instructions**

Answer **all** questions in the spaces provided.

**Question 1** (8 marks)

Consider the following information about wheat crops:

- The wheat crops have orange-brown pustules\* that are circular or oval in shape.
- The pustules are raised above the leaf surface and are mainly on the upper surface of the leaf.
- The pustules can be rubbed off the leaf, leaving an orange-brown mark on the finger.

\*pustules – small, raised spots or rounded swellings

- a. Identify the disease that causes the problem described above. 1 mark

\_\_\_\_\_

- b. Describe one strategy to prevent this disease and one strategy to control this disease. 4 marks

Strategy to prevent this disease \_\_\_\_\_

\_\_\_\_\_

\_\_\_\_\_

Strategy to control this disease \_\_\_\_\_

\_\_\_\_\_

\_\_\_\_\_

- c. Explain the impact of this disease on the wheat industry. 3 marks

\_\_\_\_\_

\_\_\_\_\_

\_\_\_\_\_

\_\_\_\_\_

\_\_\_\_\_

\_\_\_\_\_

DO NOT WRITE IN THIS AREA

**Question 2** (4 marks)

Legislation and policies can affect the sustainability of Australian agricultural and horticultural businesses. For each of the four issues identified in the table below, a relevant Act has been listed.

Identify one potential positive impact on the environmental, economic or social sustainability of an agricultural and/or horticultural business if the provisions of the relevant Act are followed.

Issue	Relevant Act	One potential positive impact on the sustainability of an agricultural and/or horticultural business
unsafe working conditions, including bullying	<i>Occupational Health and Safety Act 2004</i>	
disposal of unused chemicals, old paint, fuels and oil (dangerous litter) from a farm	<i>Catchment and Land Protection Act 1994</i>	
selling fodder or grain that contains the seeds or any part of a noxious weed	<i>Environment Protection Act 1970</i>	
controlling weeds and pests on a neighbouring farm or by the roadside without permission	<i>Environment Protection Act 1970</i>	

DO NOT WRITE IN THIS AREA

TURN OVER

**Question 3** (11 marks)

In recent years, consumer demand for free-range eggs rather than cheaper cage eggs has increased significantly.

Legislation defines free-range egg farming as the production of eggs that come from hens that are free to roam and forage outdoors for at least eight hours a day. The maximum outdoor stocking density for a free-range egg farm is 10 000 hens per hectare of land or one hen per square metre. These hens have greater bone strength because they are allowed to move more and are more active. However, there is also a greater occurrence of manure-borne diseases and parasites in free-range hens and a greater number of sick hens that need to be treated. Free-range hens are also more prone to feather pecking, infighting and cannibalism. They may suffer from social stresses and are more likely to be exposed to predators such as foxes and eagles.

Cage eggs are produced by hens that are housed in cages inside large, climate-controlled sheds. These sheds have multiple tiers, with a conveyor belt between each level to catch and remove manure automatically. Cage hens are protected from predators such as foxes and eagles, but they have less social interaction with other hens and cannot practise their natural behaviours such as nesting and dust bathing.

- a. Describe **one** advantage of free-range egg production. 2 marks

---

---

---

---

- b. Describe **one** advantage of cage egg production. 2 marks

---

---

---

---

- c. Suggest why the Australian Government has introduced legislation that defines free-range egg production. 2 marks

---

---

---

---

DO NOT WRITE IN THIS AREA



**Question 4 (6 marks)**

Bunches of cut flowers were once only available for sale in florists. Cut flowers can now be bought in many supermarkets, convenience stores and service stations. This expansion has changed the cut flower industry in Australia and resulted in increased sales.

However, not all cut flowers are freshly picked in Australia; some cut flowers are imported from other countries. Some of these countries have poor standards when it comes to the treatment of workers and the use of chemicals in the cut flower industry. Therefore, it has been proposed by Flower Industry Australia (the peak body for flower growers in Australia) to introduce ‘country of origin’ labelling to the cut flower industry to address this issue. Under the proposal, all locally grown flowers and imported flowers will need to be labelled. However, there is concern that the cut flower industry is not equipped to manage this major task and the proposal has the potential to force small operators out of business.

- a. Explain **one** reason why broadening the market for cut flowers may have contributed to increased sales. 2 marks

---

---

---

---

- b. Analyse how ‘country of origin’ labels on cut flowers may affect the promotion of Australian cut flowers. 4 marks

---

---

---

---

---

---

---

---

DO NOT WRITE IN THIS AREA

**Question 5 (7 marks)**

‘Drought is a major agricultural challenge in Australia, affecting food production, farmers’ livelihoods and costing the government billions of dollars in relief efforts.’

Source: quote from Dr Arun Yadav in Australian National University, Newsroom, ‘Scientists find new way to develop drought-resilient crops’, 16 October 2019, <[www.anu.edu.au/news/all-news/scientists-find-new-way-to-develop-drought-resilient-crops](http://www.anu.edu.au/news/all-news/scientists-find-new-way-to-develop-drought-resilient-crops)>

- a. Outline how drought may influence each of the following dimensions of sustainability. 3 marks

Environmental \_\_\_\_\_

\_\_\_\_\_

Economic \_\_\_\_\_

\_\_\_\_\_

Social \_\_\_\_\_

\_\_\_\_\_

- b. Plant science researchers are developing plants that are drought tolerant and water efficient. In Australia, scientists have identified a new combination of genes that may help crops survive in hot and dry conditions. This will increase yields and help crops adapt to heat and drought stress brought about by climate change.

Evaluate how growing drought-tolerant and water-efficient grain crops may contribute to reducing the effects of climate change on food and fibre production. 4 marks

\_\_\_\_\_

\_\_\_\_\_

\_\_\_\_\_

\_\_\_\_\_

\_\_\_\_\_

\_\_\_\_\_

\_\_\_\_\_

\_\_\_\_\_

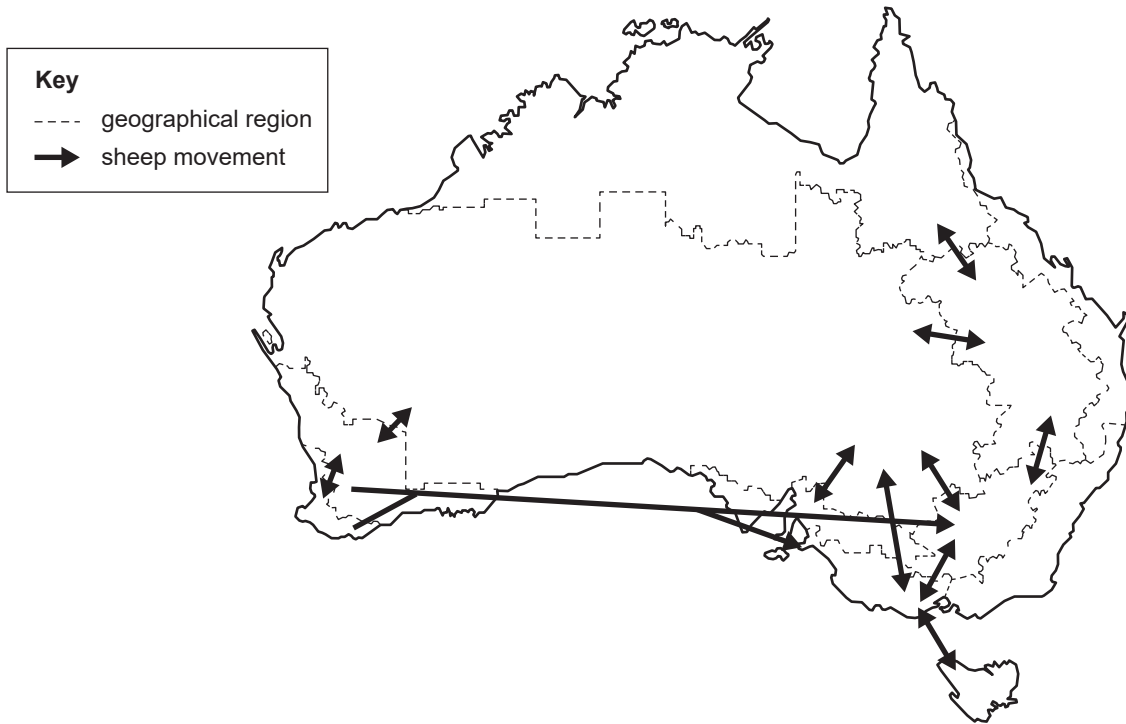
\_\_\_\_\_

\_\_\_\_\_

DO NOT WRITE IN THIS AREA

**Question 6 (5 marks)**

The image below shows significant patterns of sheep movement in Australia.



Source: adapted from Australian Government, Department of Agriculture, Fisheries and Forestry, 'Livestock movement summary', <[www.agriculture.gov.au/agriculture-land/animal/health/livestock-movement-australia/livestock\\_movement\\_summary#snapshot-1-structure-and-dynamics-of-australias-sheep-population](http://www.agriculture.gov.au/agriculture-land/animal/health/livestock-movement-australia/livestock_movement_summary#snapshot-1-structure-and-dynamics-of-australias-sheep-population)>

- a. With reference to the image above, explain how implementing national and property biosecurity measures can help ensure a positive impact on Australian sheep production. 3 marks

---

---

---

---

---

---

---

DO NOT WRITE IN THIS AREA



- b. Suggest how electronic identification of sheep can improve the efficiency of flock management. 2 marks

---

---

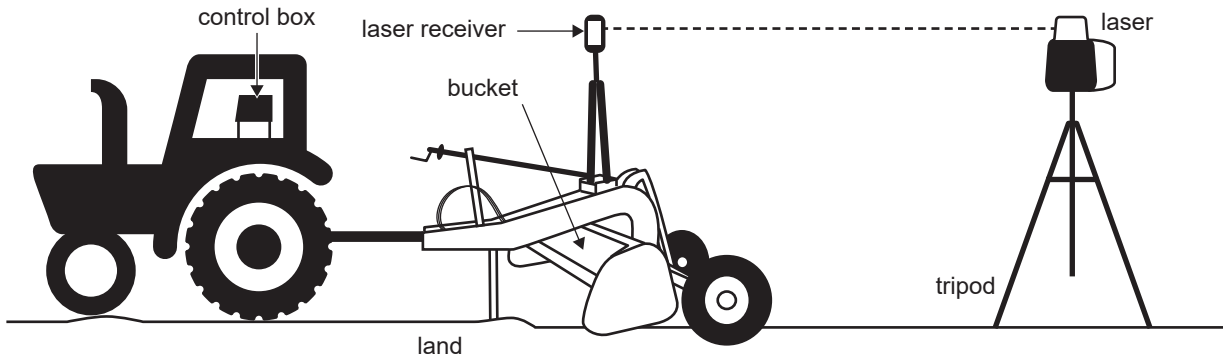
---

---

DO NOT WRITE IN THIS AREA

TURN OVER

**Question 7 (5 marks)**



Source: adapted from Celec, <www.celec.com>

The diagram above shows a laser leveller being used on a paddock. This technology uses heavy machinery to create accurate, levelled grade across a paddock, achieving a flat soil surface for planting and irrigating. Previously this was done using the farmer’s sight and judgment.

- a. Identify **one** benefit of using a laser leveller to modify the topography of land. 1 mark

---

- b. Explain **two** reasons why a farmer would want to modify the topography of their land. 4 marks

---

---

---

---

---

---

---

---

---

---

DO NOT WRITE IN THIS AREA

**Question 8** (6 marks)

Carl operates a large cropping and sheep property with limited internal fences. He has continuously cropped the same land using heavy machinery for the last 20 years. Carl's property has a number of different grain crops, including wheat, barley and lupins. When the crops are harvested, Carl buys young lambs to eat the grain left on the ground after the harvest. This grain helps fatten the lambs for market. Over the last two years, the yields of the crops have been reduced in areas where there is heavy, clay soil, due to soil compaction issues.

- a. List **two** possible reasons why soil compaction has occurred. 2 marks

---

---

---

---

- b. Identify and describe **one** action that Carl could take to **prevent** soil compaction on his property. 2 marks

---

---

---

---

- c. Identify and describe **one** action that Carl could take to **control** soil compaction on his property. 2 marks

---

---

---

---

DO NOT WRITE IN THIS AREA

TURN OVER

**Question 9 (10 marks)**

The potential for seaweed to reduce methane emissions in sheep and cattle is being [exaggerated] and investors are at risk, according to one of the nation’s leading experts on seaweed.

Dr Pia Winberg is a world-renowned marine ecologist, who has developed Australia’s first commercial seaweed farm on the south coast of New South Wales.

Australia’s peak scientific agency CSIRO discovered the methane-reducing properties of *Asparagopsis* seaweed, and claims its FutureFeed additive [which contains *Asparagopsis*] will reduce the near 10 per cent of Australian emissions caused by burping sheep and cattle [ruminant animals].

...

Dr Winberg said *Asparagopsis* could technically help reduce greenhouse gases caused by the digestive process of ruminant animals, but it was likely to take decades to become commercially viable.

...

[Dairy farmer] Mr Gardner hopes *Asparagopsis* will eventually reduce his dairy farm’s greenhouse gas emissions by up to two thirds and replicate production benefits flagged in earlier CSIRO studies.

‘In some cases there was more than 20 per cent increase in feed conversion efficiencies in beef cattle,’ Mr Gardner said.

Source: adapted from M Ellis and S Murphy, ‘Is asparagopsis seaweed a key way to reduce methane emissions in sheep and cattle, or risky investment’, ABC News, 7 March 2021, <www.abc.net.au>; reproduced by permission of the Australian Broadcasting Corporation – Library Sales; Landline © 2021 ABC

This research into feeding seaweed to sheep and cattle is attempting to address a challenge faced by the food and fibre industries.

- a. Describe the challenge that the research is attempting to address to reduce the effects of climate change.

2 marks

---

---

---

---

DO NOT WRITE IN THIS AREA



**Question 10** (8 marks)

**a.** Identify two features of a natural ecosystem and two features of a managed ecosystem.

4 marks

Natural ecosystem

1. \_\_\_\_\_

2. \_\_\_\_\_

Managed ecosystem

1. \_\_\_\_\_

2. \_\_\_\_\_

**b.** Explain the relationships between biodiversity and sustainable agriculture and horticulture in Australia.

4 marks

\_\_\_\_\_

\_\_\_\_\_

\_\_\_\_\_

\_\_\_\_\_

\_\_\_\_\_

\_\_\_\_\_

\_\_\_\_\_

\_\_\_\_\_

DO NOT WRITE IN THIS AREA

**Question 11 (9 marks)**

Blue-green algae is a naturally occurring organism in waterways. Blue-green algae affects the quality of water. Blooms (mass growths) of algae can occur in response to favourable growing conditions, which include still or slow-flowing water, abundant sunlight, hot temperatures and sufficient levels of nutrients, such as phosphorus and nitrogen.

- a. Identify and describe two agricultural and/or horticultural practices that could contribute to a blue-green algal bloom. 4 marks

1. \_\_\_\_\_

\_\_\_\_\_

2. \_\_\_\_\_

\_\_\_\_\_

- b. List two effects that blue-green algal blooms can have on agriculture or horticulture. 2 marks

1. \_\_\_\_\_

2. \_\_\_\_\_

- c. Explain **one** control method to reduce the occurrence and effects of blue-green algal blooms. 3 marks

\_\_\_\_\_

\_\_\_\_\_

\_\_\_\_\_

\_\_\_\_\_

DO NOT WRITE IN THIS AREA

TURN OVER

**Question 12** (12 marks)

Autonomous technology has traditionally been used to milk cows, but there are innovations that could enable the use of autonomous technology in other areas of the food and fibre industries, such as on farms to remove weeds and to protect crops from pests and diseases. Despite the potential contributions of autonomous technology such as robots to agricultural sustainability, there are social, legal and ethical issues that threaten their adoption.

- a. Describe **two** negative impacts that autonomous technology might have on agricultural and horticultural production.

4 marks

---

---

---

---

---

---

---

---

---

---

- b. Discuss the changing role of technology and innovation in agricultural and horticultural industries in supporting economic sustainability.

4 marks

---

---

---

---

---

---

---

---

---

---

DO NOT WRITE IN THIS AREA



- c. Describe the principles of integrated weed management and suggest how the use of autonomous technology could be included in an integrated weed management plan.

3 marks

---

---

---

---

---

---

---

- d. Suggest why using autonomous technology does not guarantee total weed control.

1 mark

---

---

DO NOT WRITE IN THIS AREA

TURN OVER

**Question 13 (9 marks)**

Rabbits are considered a pest in Australia. They were introduced into the wild in Australia in the 1850s. Fifty years later, rabbits had become a widespread pest across Australia, resulting in major environmental damage. Uncontrolled rabbit infestations resulted in unhealthier ecosystems, fewer plant species, reduced plant growth, more weeds and increased erosion. The damage from uncontrolled rabbit infestations is estimated to cost Australian agriculture approximately \$200 million per year.

Traditional biological control methods have been used to reduce rabbit numbers. These biological control methods include the introduction of the myxoma virus and rabbit haemorrhagic disease virus (calicivirus) to reduce the number of rabbits as pests. Both viruses have been successful in reducing the number of rabbits as pests. However, both the viruses and the rabbits are constantly evolving, resulting in rabbit numbers increasing again. Despite this, another biological control (a Korean strain of the rabbit haemorrhagic disease virus) was released in 2017. The release of this virus is part of a 20-year national biological control plan for rabbits.

Research into other control methods for rabbits continues. One such area of research is genetic biological control. Genetic biological control is an emerging technology that involves the application of advances in precision gene-editing technologies to introduce controlling biological traits into pest animal populations to reduce their environmental impacts or to remove their reproductive capacity.

- a. Describe 'biological resistance'. 2 marks

---

---

---

- b. Outline why biological resistance is important to food and fibre industries. 2 marks

---

---

---

- c. Discuss how biological resistance could have occurred in wild rabbits. 2 marks

---

---

---

---

- d. With reference to Australia's food and fibre industries, explain why it is important to **continue** to research ways to reduce the wild rabbit population in Australia.

3 marks

---

---

---

---

---

---

---

---

---

---

DO NOT WRITE IN THIS AREA

END OF QUESTION AND ANSWER BOOK