External assessment 2023

Multiple choice question book

Agricultural Science

Paper 1

General instruction

- Work in this book will not be marked.

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Section 1

Instruction

- Respond to these questions in the question and response book.

QUESTION 1

A farmer has purchased a neglected overgrown orchard. Which option would be the initial strategy to use in an IPM strategy?

(A) chemical control of pests and diseases

(B) biological control using predators

(C) physical removal of vegetation

(D) physical traps for insects

QUESTION 2

Identify where most fat digestion occurs in monogastric animals.

(A) liver

(B) mouth

(C) stomach

(D) small intestine

QUESTION 3

The table identifies the functions of different plant hormones.

Function	Hormone			
	Auxin	Ethylene	Gibberellin	Abscisic acid
Germination	✗	✗	✓	✗
Growth to maturity	✓	✗	✓	✗
Flowering	✓	✓	✓	✗
Fruit development	✓	✓	✓	✗
Seed dormancy	✗	✗	✗	✓

Identify which hormone contributes primarily to reproductive stage development in plants.

(A) auxin

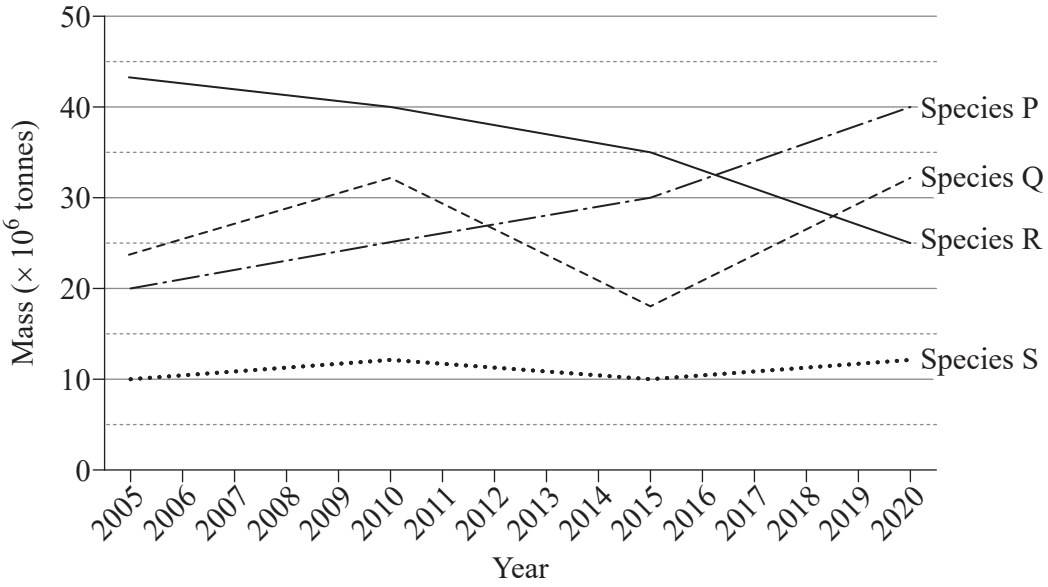
(B) ethylene

(C) gibberellin

(D) abscisic acid

QUESTION 4

The graph shows the population data for edible marine species found in a native fishery.



Which species would be most suitable for establishing a sustainable agricultural enterprise?

(A) Species P

(B) Species Q

(C) Species R

(D) Species S

QUESTION 5

Which ration would best suit the general nutritional requirements of an egg-laying chicken?

Ration	Minimum protein (%)	Minimum calcium (%)	Maximum crude fibre (%)
(A)	19.5	1.0	6.0
(B)	15.5	3.5	10.0
(C)	15.5	1.0	11.5
(D)	15.0	4.0	10.0

QUESTION 6

Australian horticultural industries were impacted by two free trade agreements that came into effect on 1 January 2019. The table shows data for fresh horticultural exports from Australia to another country under these agreements between 1 January 2018 and 31 December 2020.

Crop	Export (t)		
	2018	**2019**	**2020**
Asparagus	62	91	118
Avocados	2510	2601	1575
Cherries	278	320	325
Potatoes	12 391	23 174	20 165

Identify which crop had the best outcome from the agreements.

(A) asparagus

(B) avocados

(C) cherries

(D) potatoes

QUESTION 7

Which strategy would most effectively reduce turbidity in a creek running through an extensive cattle operation?

(A) erect stock fences along the creek

(B) remove aquatic vegetation from the creek

(C) limit the stocking rate of cattle over the operation

(D) increase the level of chemical control of weeds along the creek bank

QUESTION 8

Deformed bones were observed in an animal herd. This condition is most likely caused by a deficiency in

(A) iron.

(B) calcium.

(C) nitrogen.

(D) phosphorus.

QUESTION 9

The table shows nutrient composition of the feeds available for dairy cattle on a farm.

Feed	Crude protein (g/kg DM)	Metabolisable energy (MJ/kg DM)	Dry matter (%)
Silage	120	9.5	54
Hay	140	9.9	87
Barley	130	11.2	90
Lupin	380	12.9	88
N-fertilised turnip leaf	190	12.5	14

If a ration consisting of 3 kg silage, 5 kg barley and 2 kg N-fertilised turnip leaf was supplied to each animal, what would be the total available crude protein and metabolisable energy?

	Crude protein (g)	Metabolisable energy (MJ)
(A)	1390	120
(B)	1159	91
(C)	998	82
(D)	833	69

QUESTION 10

The table shows yield and variable costs associated with different methods of cotton production. Income is $680 per bale for lint and seed.

Which method would provide the highest gross margin per hectare?

Method	Production system	Yield (bales/ha)	Variable costs ($/ha)
(A)	Irrigated	12.0	3982
(B)	Irrigated	12.0	4088
(C)	Dryland	4.0	1424
(D)	Dryland	3.5	1290

QUESTION 11

Identify which factors affect decisions made about property management.

(A) food security, market suitability

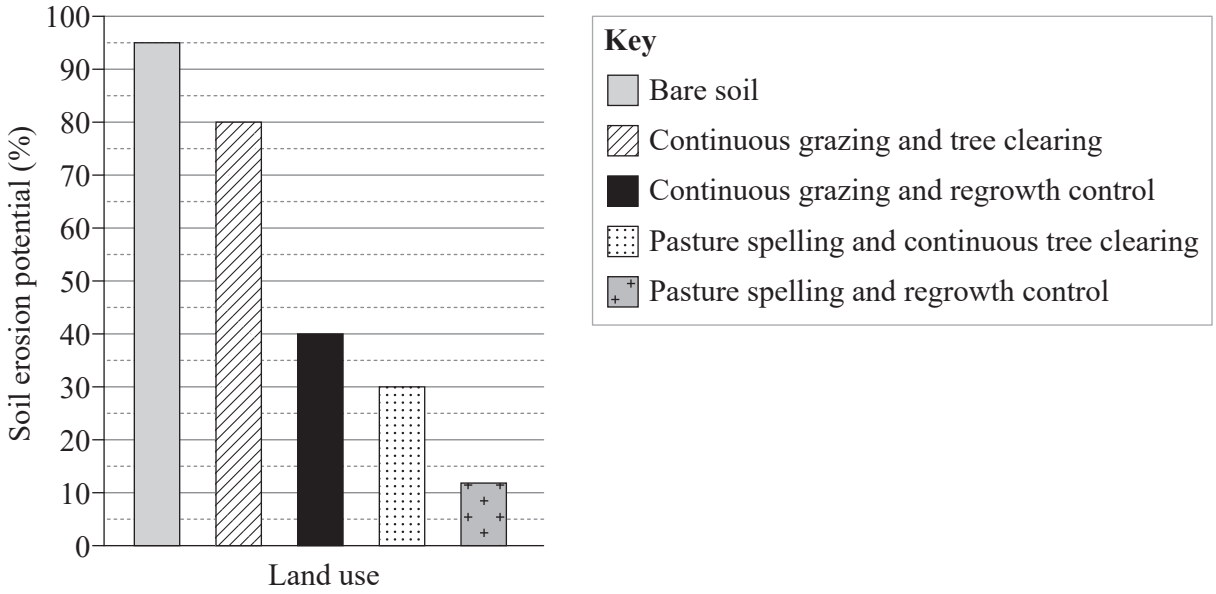
(B) location to markets, food quality

(C) financial considerations, human resources

(D) environmental factors, population distribution

QUESTION 12

The graph shows the soil erosion potential for different agricultural land uses.



What would be the reduction in the percentage of soil erosion if pastures were spelled with control of regrowth compared to continuous grazing and tree clearing?

(A) 18%

(B) 28%

(C) 68%

(D) 83%

QUESTION 13

Two farms implemented different strategies for managing drought.

Farm A	Farm B
Improved nutrition	Built a silo
Retained breeding stock	Sold all steers and culled animals based on age
Implemented supplementary feeding	Used paddock rotation
Monitored ground cover	Maintained appropriate stocking rates

Which steps in the PPRR management model were demonstrated by both farms?

(A) prevention, response, recovery

(B) preparedness, response, recovery

(C) prevention, preparedness, recovery

(D) prevention, preparedness, response

QUESTION 14

Australian agricultural products are often referred to as ‘clean and green’ because

(A) produce is grown through conventional methods and sold directly to consumers.

(B) sustainable methods are used to produce food with quality assurance programs.

(C) the food produced is considered safe and farming systems maintain soil health.

(D) there is limited use of chemicals and genetic breeding is used to control pests.

QUESTION 15

The table shows an excerpt of income and variable costs from a maize enterprise.

	Budget ($/ha)
Income	
Maize	930
Costs	
Sowing	165
Fertiliser & application	156
Herbicide & application	102
Insecticide & application	25
Harvesting	67
Crop levies and insurance	48

Calculate the gross margin per hectare for the enterprise.

(A) $367

(B) $415

(C) $563

(D) $1493

QUESTION 16

Which management strategy would control pests and diseases in an extensive animal industry?

(A) visual inspections of poultry sheds

(B) removing animal waste from a cattle feedlot

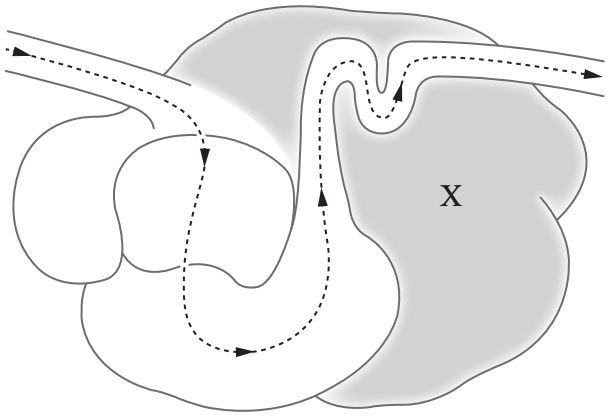
(C) selection of short-coated cattle for animal production

(D) maintenance of pastures in free-range egg production

QUESTION 17

The diagram represents a ruminant stomach.

Not to scale



The main nutritional contribution of the microbes found in X is

(A) vitamin C synthesis.

(B) cellulose breakdown to volatile fatty acids.

(C) increased absorption of potassium and phosphorus.

(D) methane production from carbohydrate breakdown.

QUESTION 18

Minimum tillage practices can

(A) speed up water loss from the soil profile.

(B) increase the rate of carbon loss from the soil.

(C) reduce disease and populations of soil-borne pests.

(D) improve infiltration of water through the soil profile.

QUESTION 19

A cash flow statement for a farm was recorded for a three-month period.

Month	Income ($)	Costs ($)	Balance ($)
July	15 600	8231	
August	3000	4122	
September	13 432	1000	

Calculate the September balance.

(A) $1000

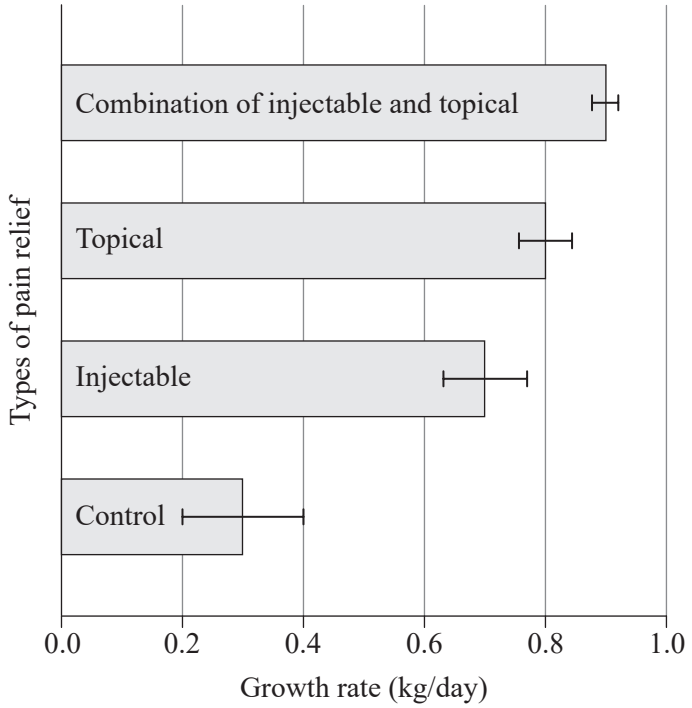
(B) $6185

(C) $13 616

(D) $18 679

QUESTION 20

Consumer demand has resulted in the availability of more pain relief strategies for animal husbandry procedures. The graph shows the effect of different types of pain relief on the average growth rate of calves in the first month after castration. The graph includes standard error bars.



Which two types of pain relief show statistically similar mean values for growth rate?

(A) control and topical

(B) injectable and topical

(C) topical and combination of injectable and topical

(D) injectable and combination of injectable and topical

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References

Question 5

Data sourced from:

Chick Starter formulation from Barastoc, https://barastocpoultry.com.au/our-products/essentials-range/chick-starter/

Golden Yolk formulation from Barastoc, https://barastocpoultry.com.au/our-products/essentials-range/golden-yolk/

Question 10

Data derived from Revell, G, Welsh, J & Powell, J 2022, 'Australian cotton industry gross margin budgets', *CottonInfo*, www.cottoninfo.com.au/publications/australian-cotton-industry-gross-margin-budgets

Question 17

Adapted from Pearson Scott Foresman 2008, 'Abomasum', *Wikimedia Commons,* https://commons.wikimedia.org/wiki/File:Abomasum_(PSF).png

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School name

Given name/s

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Book ☐ of ☐ books used

External assessment 2023

Question and response book

Agricultural Science

Paper 1

Time allowed

- Perusal time — 10 minutes
- Working time — 90 minutes

General instructions

- Answer all questions in this question and response book.
- QCAA-approved calculator permitted.
- Planning paper will not be marked.

Section 1 (20 marks)

- 20 multiple choice questions

Section 2 (27 marks)

- 7 short response questions

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Section 1

Instructions

- This section has 20 questions and is worth 20 marks.
- Use a 2B pencil to fill in the A, B, C or D answer bubble completely.
- Choose the best answer for Questions 1–20.
- If you change your mind or make a mistake, use an eraser to remove your response and fill in the new answer bubble completely.

	A	B	C	D
Example:	●	○	○	○

	A	B	C	D
1.	○	○	○	○
2.	○	○	○	○
3.	○	○	○	○
4.	○	○	○	○
5.	○	○	○	○
6.	○	○	○	○
7.	○	○	○	○
8.	○	○	○	○
9.	○	○	○	○
10.	○	○	○	○
11.	○	○	○	○
12.	○	○	○	○
13.	○	○	○	○
14.	○	○	○	○
15.	○	○	○	○
16.	○	○	○	○
17.	○	○	○	○
18.	○	○	○	○
19.	○	○	○	○
20.	○	○	○	○

Ensure you have filled an answer bubble for each question.

Do not write outside this box.

Section 2

Instructions

- Write using black or blue pen.
- If you need more space for a response, use the additional pages at the back of this book.
  - On the additional pages, write the question number you are responding to.
  - Cancel any incorrect response by ruling a single diagonal line through your work.
  - Write the page number of your alternative/additional response, i.e. See page …
  - If you do not do this, your original response will be marked.
- This section has seven questions and is worth 27 marks.

QUESTION 21 (4 marks)

Explain the post-harvest processes involved in getting a horticultural plant product of your choice from the farm to the shop.

Do not write outside this box.

QUESTION 22 (2 marks)

The table shows expected feed consumption per day and mass gained per day for an agricultural animal at various stages of growth.

Life stage	Mass of food eaten (kg)	Mass gained (kg)	Feed conversion ratio (FCR)
Yearling	6.3	1.1	5.7
Weaner	6.6	1.2	5.5
Adult	5.4	0.7	

a) Determine the FCR for adults. *[1 mark]*

b) Identify the trend between an animal's age and its FCR. *[1 mark]*

Do not write outside this box.

QUESTION 23 (8 marks)

The Varroa mite is a honeybee parasite that has a major impact on overseas honey and related enterprises, killing large populations of bees and weakening colonies. If uncontrolled, Varroa mite infestation in honeybee colonies severely impacts honey production, but can also affect a wide range of pollination-reliant crops.

a) Identify two management strategies that beekeepers or biosecurity officers could implement to restrict the movement of Varroa mite outside of an infested area. *[2 marks]*

b) Identify another pest associated with an agricultural animal of regional importance and explain its effect on this animal. *[2 marks]*

c) Describe two stages of the life cycle of the pest from Question 23b). *[2 marks]*

Do not write outside this box.

d) Identify the point in the life cycle of the pest from Question 23b) where it is most vulnerable and explain why. *[2 marks]*

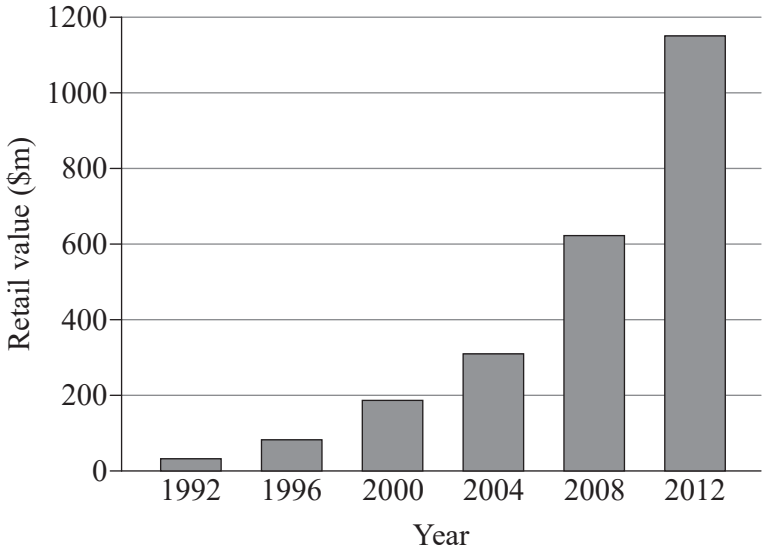
QUESTION 24 (3 marks)

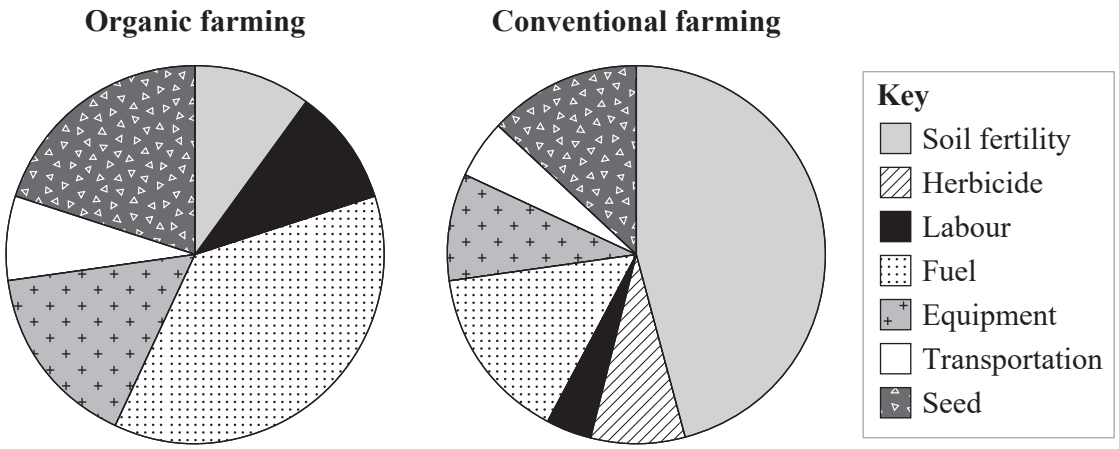
Explain how sowing rates and plant spacings differ between dryland and irrigated environmental conditions for a broadacre crop of your choice.

Do not write outside this box.

QUESTION 25 (4 marks)

The graphs show the change in retail value for organic production in Australia and the energy profiles (proportion of energy per activity) for organic farming compared to conventional farming.





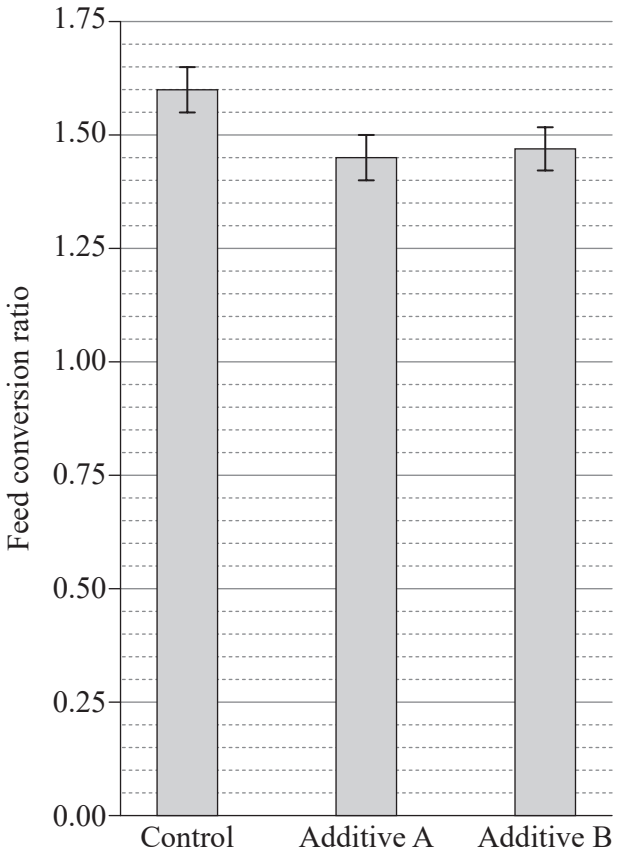
Do not write outside this box.

Draw two conclusions about the social sustainability of organic farming enterprises in Australia using the criteria of income and employment. Justify each conclusion using evidence from the graphs.

Do not write outside this box.

QUESTION 26 (3 marks)

An experiment was conducted to assess the effect food additives had on weight gain in layer chickens. The graph shows the feed conversion ratios for layer chickens fed two different additives compared to a commercial ration (the control).



Draw a conclusion about which feed type provides the optimal feed conversion for layer chickens. Use two pieces of evidence from the graph to support your conclusion.

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Do not write outside this box.

QUESTION 27 (3 marks)

Aphids are a common pest in cereal crops. The table identifies different control methods.

Control method
Monitoring aphid population
Crop rotation
Preserving predators, e.g. ladybirds
Introducing enemies, e.g. parasitic wasps
Use of insecticides
Use of seed dressings

a) Identify which control methods are biological controls. *[1 mark]*

b) Explain two advantages of using biological controls. *[2 marks]*

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ADDITIONAL PAGE FOR STUDENT RESPONSES

Write the question number you are responding to.

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ADDITIONAL PAGE FOR STUDENT RESPONSES

Write the question number you are responding to.

Do not write outside this box.

References

Question 25

Data adapted from Monk, A 2013, *Figure 1: Retail value growth 1990–2012* in 'Australian organic market reporting — Tracking horticultural organic growth, trends and markets', HAL, https://www.horticulture.com.au/globalassets/hort-innovation/historic-reports/australian-organic-market-reporting--tracking-horticultural-organic-growth-trends-and-markets-hg08080.pdf

Adapted from Fess, T, Benedito, V 2018, *Figure 7: Comparison of energy consumption in organic and conventional systems for annual crops* in 'Organic versus conventional cropping sustainability: A comparative system analysis', Faculty and Staff Scholarship, https://researchrepository.wvu.edu/faculty_publications/1219/

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Book of books used

External assessment 2023

Question and response book

Agricultural Science

Paper 2

Time allowed

- Perusal time — 10 minutes
- Working time — 90 minutes

General instructions

- Answer all questions in this question and response book.
- Write using black or blue pen.
- QCAA-approved calculator permitted.
- Planning paper will not be marked.

Section 1 (39 marks)

- 10 short response questions

Section 2 (18 marks)

- 1 extended response question

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Section 1

Instructions

- If you need more space for a response, use the additional pages at the back of this book.
  - On the additional pages, write the question number you are responding to.
  - Cancel any incorrect response by ruling a single diagonal line through your work.
  - Write the page number of your alternative/additional response, i.e. See page …
  - If you do not do this, your original response will be marked.
- This section has 10 questions and is worth 39 marks.

QUESTION 1 (2 marks)

Explain a risk avoidance strategy for a lamb producer to minimise the effect of drought on farm income.

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QUESTION 2 (5 marks)

An agricultural class entered two animals into a carcass competition at a local agricultural show.
The tables show the carcass characteristics for both animals, a price grid and price penalties/premiums for the domestic market.

Animal	A	B
Carcass weight (HSCW) (kg)	270	310
Sex	Female	Male
Condition score	A	A
Bruising	Nil	Nil
MSA premium	No	Yes

HSCW (kg)	Price (c/kg)
300–359	655
280–299	650
260–279	645
240–259	640

Category	Price penalty/premium	
Sex (female)	5c/kg less than price grid	
Bruising	10c/kg less than price grid	
Condition score	A	Zero change
	B	5c/kg less than price grid
	C	30c/kg less than price grid
	D	50c/kg less than price grid
	E	80c/kg less than price grid
MSA premium	25c/kg more than price grid	

Do not write outside this box.

Determine which animal is worth more on the domestic market. Show working to justify your decision.

QUESTION 3 (3 marks)

Explain one positive and one negative consequence of genetic modification for a plant of your choice.

Do not write outside this box.

QUESTION 4 (4 marks)

The table contains agronomic information for three different varieties of an agricultural crop.

Variety	Rust (disease)		Yellow leaf spot (disease)	Crown rot (disease)	Acid soils
	Stem	Leaf			
A	MS	MR	MR	MR	T
B	R	MR	MR	MR	I
C	R	MR	MR	R	T

Key

Disease resistance		*Acid soil tolerance*	
S	Susceptible	T	Tolerant
MS	Moderately susceptible	I	Intolerant
R	Resistant		
MR	Moderately resistant		

Draw a conclusion about which crop variety should be used in high rainfall areas. Justify your conclusion with three pieces of evidence.

Do not write outside this box.

QUESTION 5 (4 marks)

Identify four differences between protein metabolism in ruminant and monogastric animals.

QUESTION 6 (3 marks)

a) Identify an asexual plant propagation method. *[1 mark]*

b) Describe the method identified in Question 6a), using an agricultural example. *[2 marks]*

Do not write outside this box.

QUESTION 7 (5 marks)

An agricultural business owns and operates a portfolio of properties, feedlots and farms in Queensland and the Northern Territory. Each property is part of the business's supply chain for breeding, growing and finishing cattle and growing grains and fodder crops to support cattle production.

Directors of this business are accountable for contributing to the success of the organisation. The business is listed on the Australian Securities Exchange.

Determine the ownership structure of the business. Justify your conclusion by identifying two characteristics of this ownership structure and use evidence to support your response.

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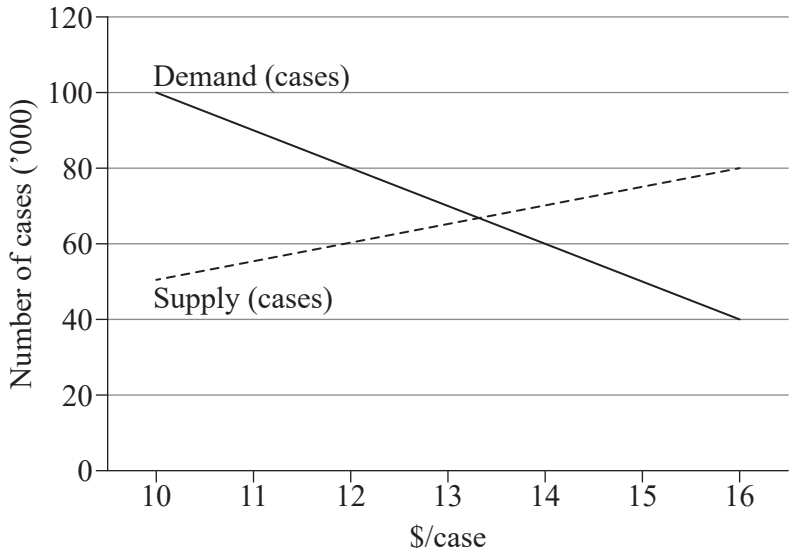
QUESTION 8 (3 marks)

The graph shows supply and demand for apricots at the start of the apricot season in southern Queensland.



Describe what effect a severe hailstorm in the major growing area for apricots would have on demand for the rest of this season. Show your reasoning.

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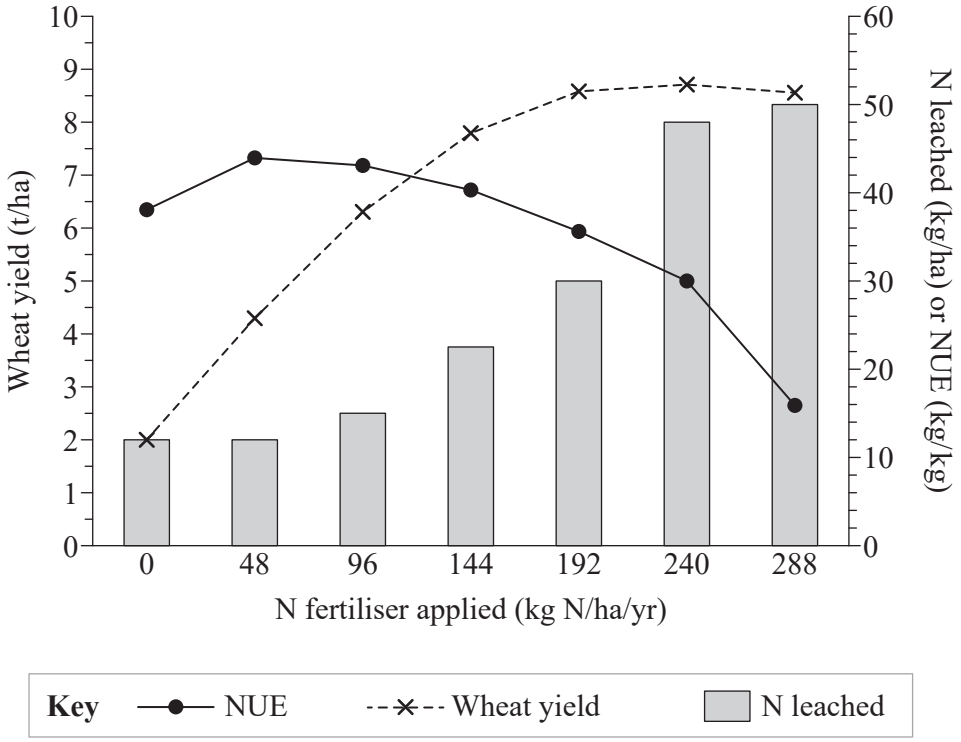
QUESTION 9 (6 marks)

The graph shows the impact of nitrogen (N) fertiliser application on wheat yield, N losses due to leaching and estimated grain nitrogen use efficiency (NUE).



a) Identify the mass of N applied to achieve the highest wheat yield per hectare. *[1 mark]*

b) Describe the trend between the level of N fertiliser applied and NUE. *[2 marks]*

Do not write outside this box.

c) Draw a conclusion about the optimal level of N fertiliser for wheat production.
Justify your conclusion using two pieces of evidence from the graph. *[3 marks]*

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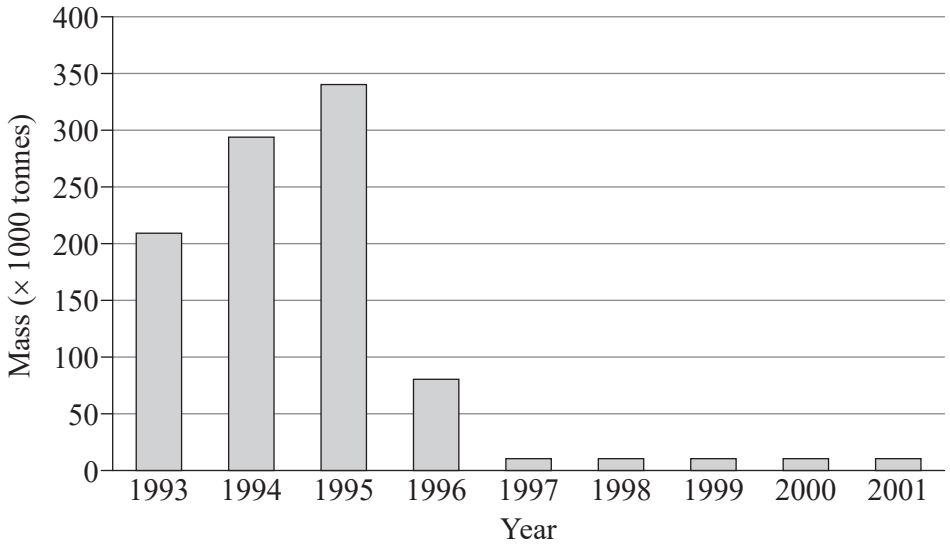
QUESTION 10 (4 marks)

Mad cow disease (BSE) is an exotic disease to Australia. It is spread by cattle eating animal products containing the disease and originated through cattle being supplemented with protein from meat and bonemeal. In 1996, BSE was identified as potentially passing from animals to humans in Great Britain.

The graph shows beef exports from Great Britain from 1993 to 2001.



a) Determine how introducing BSE to Australia could affect a cattle production system. *[2 marks]*

b) Identify two strategies Australia currently uses that reduce the risk or effect of BSE being introduced. *[2 marks]*

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Section 2

Instructions

- This section has one question and is worth 18 marks.
- Respond in 300–350 words.

QUESTION 11 (18 marks)

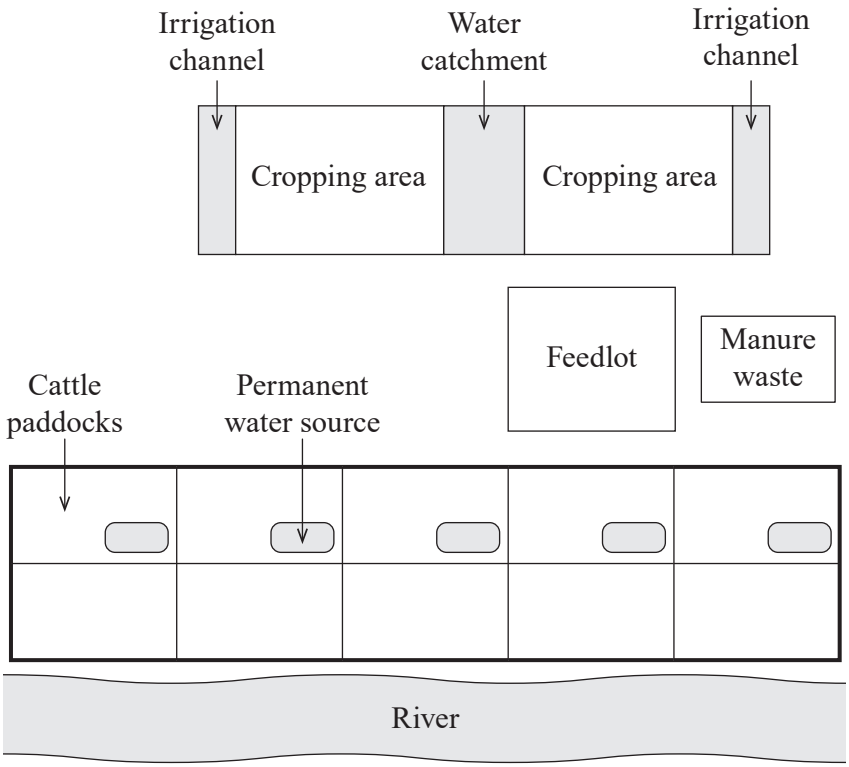
An 8000-hectare cropping/grazing property in Central Queensland runs 400 breeding cows on improved pastures (mostly buffel grass) and includes a feedlot to finish the steer offspring. It also grows irrigated crops, including cotton in summer, and wheat, barley and chickpeas as crop rotations in winter.

The cotton used is a variety genetically modified to make it resistant to a common herbicide and contains a gene that codes for the production of Bt toxin. The toxin causes the caterpillar pest *Helicoverpa sp* to die when it consumes the cotton leaves.

Water for irrigation comes from the Nogoa River, which runs through the property. Water is supplied to the Nogoa River from the Fairbairn Dam as per the irrigation licence for the enterprise. Water is then recycled through a catchment system and reused on property using water storage. Irrigation timing is based on visual appraisal of the crop.

The cattle are Santa Gertrudis, made up of 5/8 *Bos Taurus* and 3/8 *Bos Indicus*. The steers produced are finished on the property, with the feedlot located uphill from the river. Waste is removed from the feedlot and stockpiled nearby, and this sometimes flows into the river during heavy storms.

The cattle are grazed using a rotational grazing system with smaller paddocks. Half of the paddocks have a permanent water supply through troughs linked to a pump in the river. The paddocks that are located near the river use it as a water source for the cattle.



Not to scale

Use three environmental management criteria to assess sustainable practices in the production system. For each criterion, identify three strengths or weaknesses.

Draw a justified conclusion about the environmental sustainability of the production system. Explain two management practices that would improve aspects of this enterprise's environmental sustainability.

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END OF PAPER

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ADDITIONAL PAGE FOR STUDENT RESPONSES

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References

Question 9

Adapted from Hawkesford, M 2014, 'Figure 2: Illustration of impact of N fertilizer application on winter wheat yield (solid line, diamonds), N-losses due to leaching (bar chart) and estimated grain NUE (dashed line, squares)' in Reducing the reliance on nitrogen fertilizer for wheat production, *Journal of Cereal Science*, vol. 59, issue 3, pp. 276–283, www.sciencedirect.com/science/article/pii/S0733521013001859#bib27. Creative Commons Attribution 3.0 licence (CC BY 3.0)

Question 10

Data from Figure 1: World exports of British beef and cattle, 1993–2001' in Moens, A 2006, 'Mad cow: A case study in Canadian-American relations', Fraser Institute Digital Publication, www.researchgate.net/publication/237109689_Mad_Cow_A_Case_Study_in_Canadian-American_Relations.