External assessment 2022

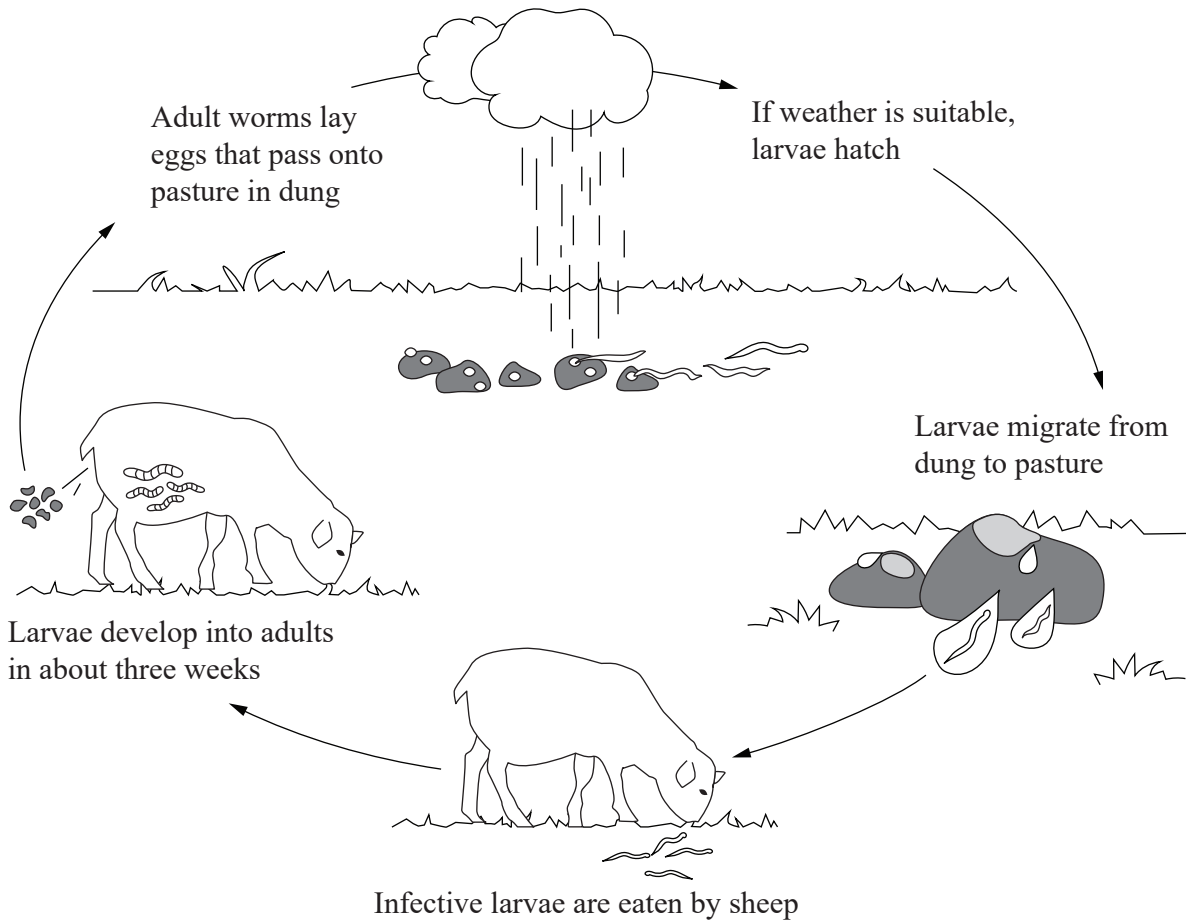# Agricultural Science

Paper 1

General instruction

• Work in this book will not be marked.

Section 1

QUESTION 1

The diagram shows the life cycle of the barber's pole worm in sheep. A strategy to break the life cycle of a worm-infected paddock is to rotate sheep with horses.

Adult worms lay eggs that pass onto pasture in dung

If weather is suitable, larvae hatch

Larvae migrate from dung to pasture

Larvae develop into adults in about three weeks

Infective larvae are eaten by sheep

How many weeks between sheep rotations would be the most suitable?

(A) one

(B) two

(C) three

(D) four

QUESTION 2

Fluctuation in the diameter of wool fibres of a purebred merino flock over a calendar year is mainly due to

(A) genetic variation among sheep.

(B) changes in the taste of leaf material.

(C) changes in temperature across the year.

(D) variation in the quality of available pasture.

QUESTION 3

The table shows a planting strategy for a producer planning to use the cotton variety Bollgard 3, which carries the Bt insecticidal protein. It includes refuge areas planted with non-Bt cotton and pigeon pea. Spraying of cotton is performed before bolling begins to ensure a threshold population is not reached and reduce the incidence of resistant moths.

Crop	Conditions	Area planted (ha)
Cotton	Irrigated, sprayed	100
Refuge cotton	Irrigated, unsprayed	5
Pigeon pea	Irrigated, unsprayed	2.5

What is the primary reason for this planting strategy in terms of integrated pest management?

(A) Either refuge crop allows breeding of non-resistant bollworm moths to dilute genetic resistance.

(B) Either refuge crop will attract most of the bollworm moths away from most of the cotton.

(C) Pigeon pea is planted to provide a refuge for predatory insects of the bollworm moth.

(D) Pigeon pea is planted to improve the nutrient profile of the soil.

QUESTIONS 4–5

These questions refer to the data in the table, which shows selected expenses for a merino enterprise.

Expenses	$
Depreciation	32 876
Seed	9456
Fertiliser	23 657
Harvesting	14 690
Rates	4789
Mustering	10 000
Vaccines	17 800
Shearing	27 549
Loan repayments	36 155
Total farm expenses	176 972

QUESTION 4

Which expense is a fixed cost?

(A) seed

(B) shearing

(C) harvesting

(D) depreciation

QUESTION 5

Determine the total variable expenses in the table.

(A) $93 152

(B) $103 152

(C) $107 941

(D) $136 028

QUESTION 6

The table shows estimated breeding values for live weight gain and reproductive characteristics for a sample of bulls.

Identify which bull a producer should buy, to sell two-year-old steers earlier at the minimum market live weight and improve female fertility.

Bull	400-day weight	600-day weight	Scrotal size	Days to calving
(A)	+46	+57	+1.8	+8
(B)	+42	+40	+2.1	−8
(C)	+36	+59	+1.5	−7
(D)	+38	+50	+2.4	+10

QUESTION 7

The first stage of fat digestion (excluding volatile fatty acids) in mature cattle occurs in the

(A) small intestine.

(B) abomasum.

(C) omasum.

(D) rumen.

QUESTION 8

An increase in the price of red meat in Queensland domestic markets will occur after

(A) a 12-month period of continuous negative southern oscillation values.

(B) an increase in customer demand for alternative vegan products.

(C) a decrease in the quota allowed for live export of cattle.

(D) above average rainfall totals across production areas.

QUESTION 9

The graph shows a change in the supply and demand of apples.
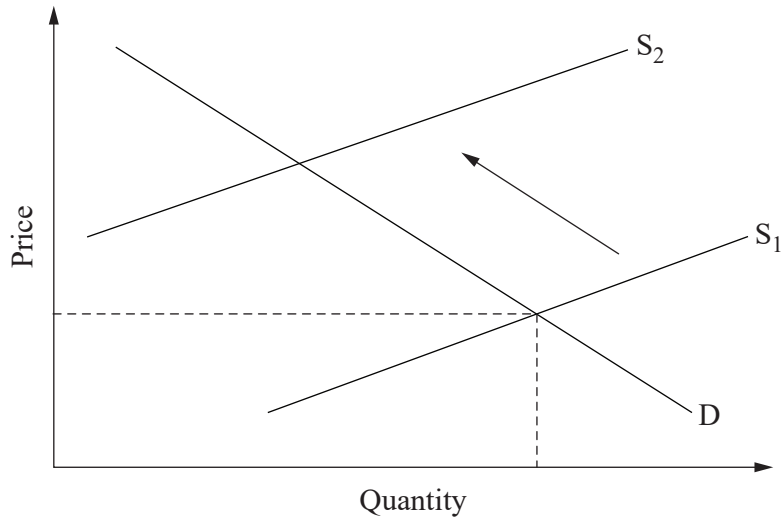
Which statement best describes the change in the supply (S), demand (D) and price of apples?

   (A)   A marketing campaign increased the demand for apples.

   (B)   Production losses in the major growing areas decreased supply.

   (C)   Increasing production costs reduced the supply for a given price.

   (D)   New technology reduced the cost for farmers and increased supply.

QUESTION 10

Select the combination of processes that best describes the role of microscopic organisms in the rumen.

	Process 1	Process 2
(A)	Absorption of nitrogen	Absorption of carbohydrates
(B)	Conversion of carbohydrates to volatile fatty acids	Conversion of nitrogen to microbial protein
(C)	Degradation of protein to amino acids	Conversion of carbohydrates to volatile fatty acids
(D)	Conversion of nitrogen to microbial protein	Absorption of carbohydrates

QUESTION 11

The diagram shows the nitrogen cycle.
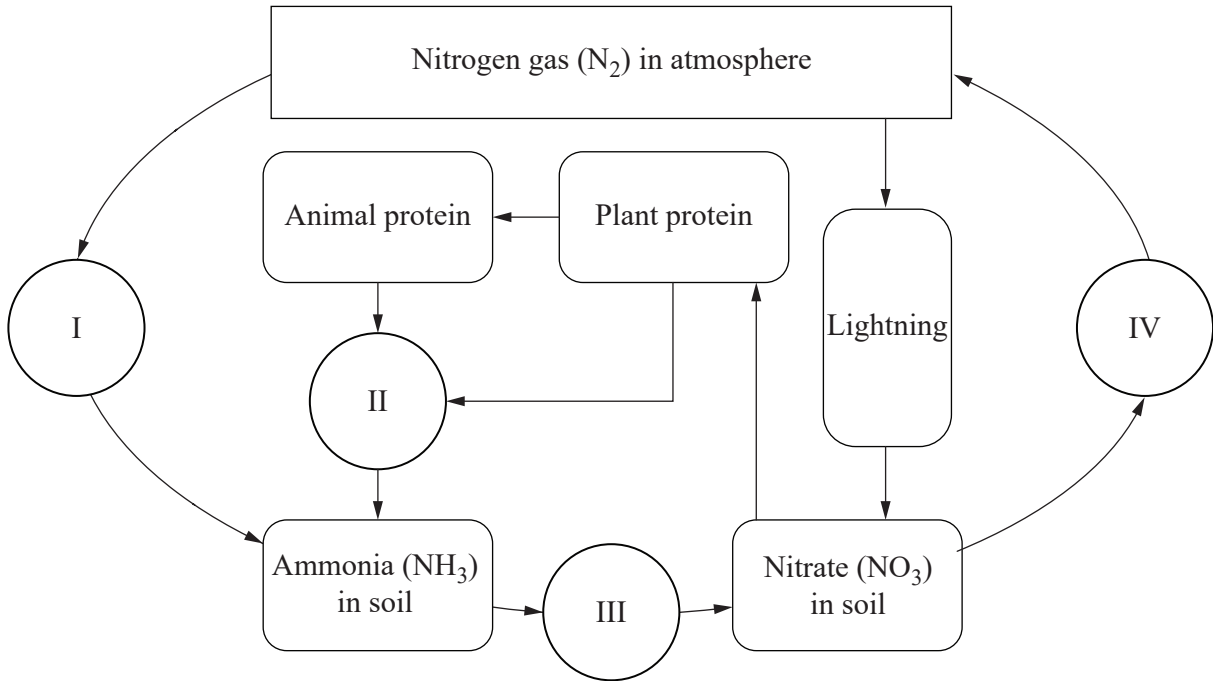
The organisms responsible for the process occurring at point I in the diagram are

(A) nitrifying bacteria.

(B) denitrifying bacteria.

(C) decomposing bacteria.

(D) nitrogen-fixing bacteria.

QUESTION 12

A beef producer expanded their business by constructing a feedlot on their breeding property.

What element of standard operating procedures for cattle in Queensland must now be a higher priority for intensive animal production?

(A) yard flooring

(B) humane killing

(C) water requirements

(D) transport and travel distance

QUESTION 13

What function does abscisic acid perform in plants?

(A) inhibiting growth

(B) stimulating root growth

(C) decreasing internodal length

(D) increasing rate of ripening fruit

QUESTION 14

Protein functions in ruminant animals include

(A) increasing marbling in meat and providing energy for muscle development.

(B) enabling chemical reactions and production of genetic material.

(C) improving water retention and increasing faecal output.

(D) improving energy output in cells and urinary function.

QUESTION 15

A characteristic of an unsustainable biological control method is

(A) a narrow host range for the biological control organism.

(B) an increase in the population of the competing species.

(C) the disappearance of the biological control organism.

(D) a reduction in the population of the targeted pest.

QUESTION 16

The graphs show the volume of exports and domestic consumption for total agricultural production, along with two agricultural industries. The table shows the value of production for these two industries.

Wheat

Fruit and nuts

Total agricultural production
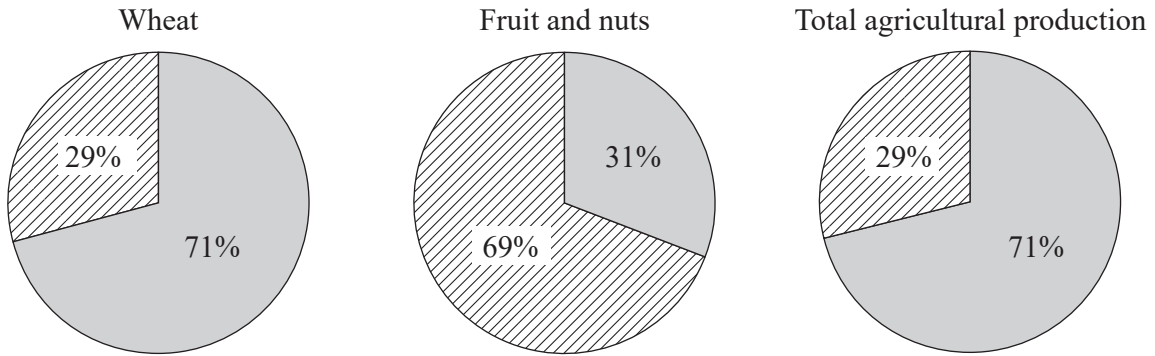
Key — exports — domestic consumption

Agricultural industry	Value of production (%)
Wheat	8
Fruit and nuts	8

In negotiations for a Free Trade Agreement between Australia and Indonesia, why would Australia insist on including wheat rather than fruit and nuts?

(A) Wheat production is much greater than fruit and nut production.

(B) Australia has a larger export market for wheat compared to fruit and nuts.

(C) Larger areas of regional Australia are planted with wheat than fruit and nuts.

(D) Domestic demand for fruit and nuts makes their export less attractive compared to wheat.

QUESTION 17

An experiment tested the effect of a hormone applied to dwarf peas at three different concentrations.
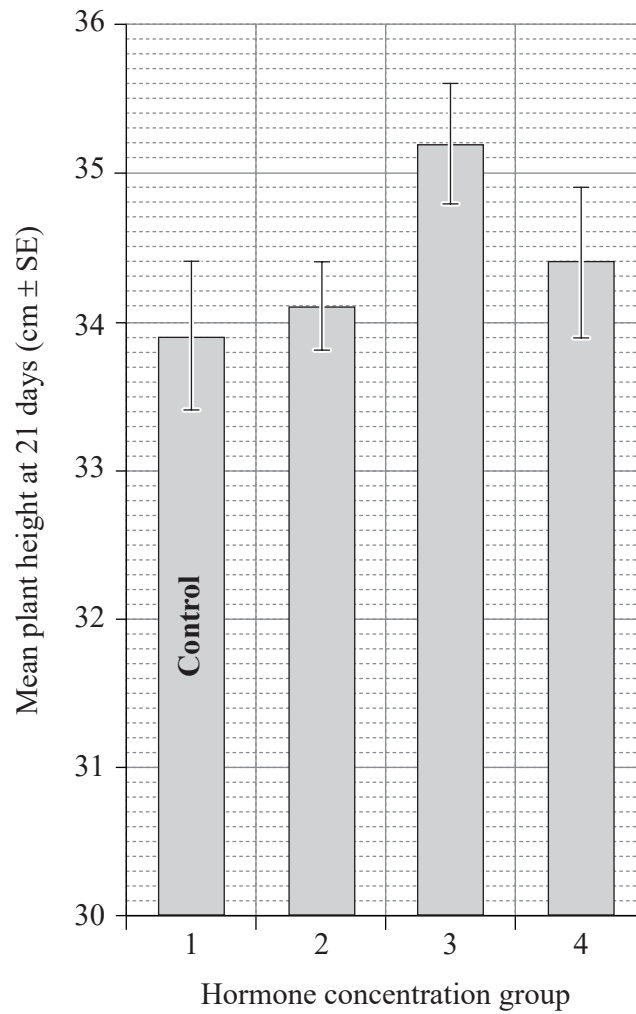
After 21 days, on average plants in

   (A)   group 1 grew less than group 2.

   (B)   group 4 grew less than group 3.

   (C)   group 3 grew more than group 1.

   (D)   group 4 grew more than group 1.

QUESTION 18

Controlled traffic as a land management practice in agricultural production is used to

  (A) reduce soil compaction.

  (B) improve the soil microbiology.

  (C) increase organic matter in the soil by retaining stubble.

  (D) incorporate matching land capabilities for long-term sustainability.

QUESTION 19

What most effectively reduces turbidity levels in creeks located in extensive cattle operations?

  (A) building weirs or dams

  (B) erecting stock fences around the creek

  (C) reducing fertiliser run-off from paddocks

  (D) implementing a rotational grazing strategy

QUESTION 20

The table shows the gross margin for a dairy enterprise that runs 300 cows on 120 hectares.

Gross income	$890 000
Variable cost	$650 000
Gross margin	$240 000

Identify the change of input that would cause the greatest effect on gross margin for the enterprise.

  (A) fertiliser costs increasing from $120/ha to $165/ha

  (B) animal health costs increasing from $60/cow to $85/cow

  (C) fixed cost of labour increasing from $120 000 to $130 000

  (D) council rates increasing from $45 000 per year to $65 000 per year

References

Question 1

Cotter, J 2018, Barber's pole worm in sheep, Western Australia Department of Primary Industries and Regional Development, www.agric.wa.gov.au/livestock-parasites/barbers-pole-worm-sheep.

Question 3

Data sourced from Table 1, 'Irrigated Bollgard 3 cotton refuge options' in CRDC and CottonInfo 2020, *Cotton pest management guide 2020–21*, p. 74, www.crdc.com.au/sites/default/files/pdf/CPMG%202020%20 interactive.pdf.

Question 16

Data sourced from ABARES 2020, *Analysis of Australia's Food Security and the COVID-19 Pandemic*, www.agriculture.gov.au/abares/products/insights/australian-food-security-and-COVID-19. Used under the Creative Commons Attribution (CC-BY) 4.0 licence.

External assessment 2022

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 (33 marks)

- 7 short response questions

Section 1

Instructions

- Choose the best answer for Questions 1–20.
- 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.
- 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.	○	○	○	○
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15.	○	○	○	○
16.	○	○	○	○
17.	○	○	○	○
18.	○	○	○	○
19.	○	○	○	○
20.	○	○	○	○

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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 33 marks.

QUESTION 21 (4 marks)

The graph shows the relationship between the mean wheat yield and the crop rotation system used.
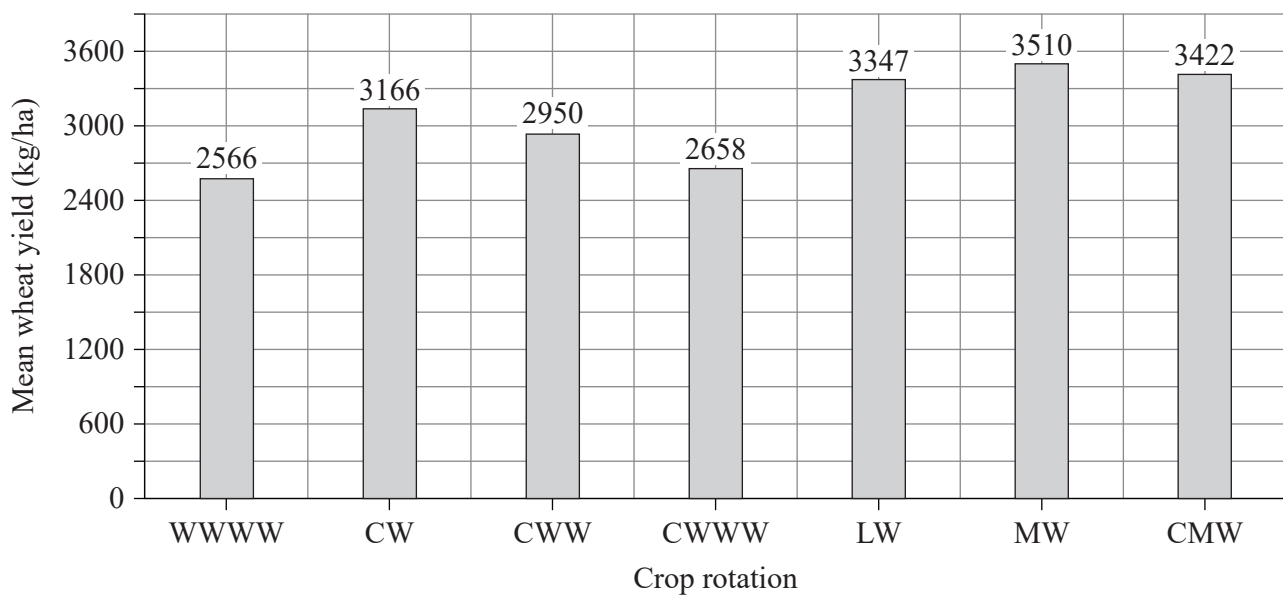
Key	W = wheat	C = canola	L = lupin	M = medic

Note: Canola has a deeper tap root system than medic species.

Draw a conclusion about which crop rotation will allow the greatest opportunity for sustainable plant production. Justify your conclusion using evidence and explain two benefits of this crop rotation system.

a) Identify two differences between the quality of feedlot rations and green fodder crops. *[2 marks]*

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A producer has recently weaned first-cross lambs that currently have a mean weight of 32 kg.
The Meat Standards Australia requirements for selling lamb, and feed options for these lambs, are shown in the tables.

Category/Cipher	Dentition H	Carcass weight (kg)	Fat score
Lamb 'L'	0 permanent incisor teeth	≥18	≥2

Fat score	Dressing percentage (lambs)	
	Unweaned (%)	Weaned (%)
1	43	41
2	45	43
3	47	45

Lamb finishing system	First-cross weight gain (g/head/day)
Green fodder crops	180
Feedlot rations	300

b) Determine the optimal feeding system to use if the weaned lambs are to go to market in 60 days, with a fat score of 3 and a maximum carcass weight of 20 kg. Show your reasoning.
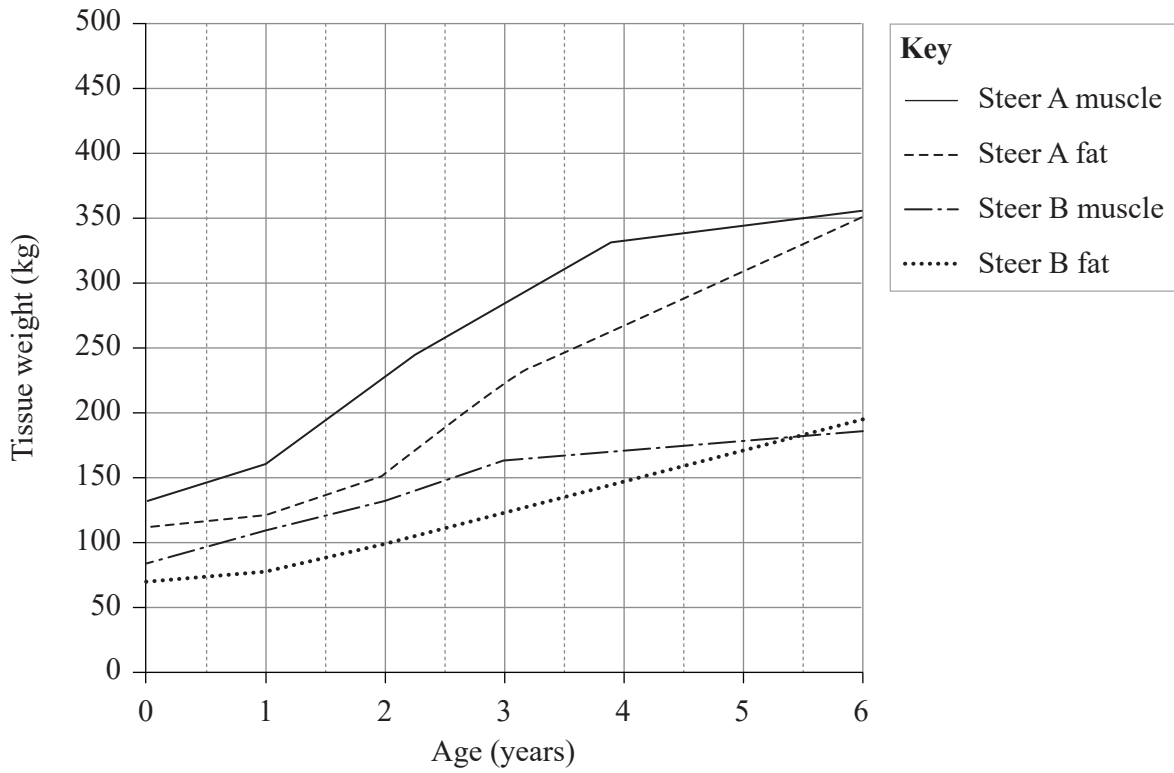
[5 marks]

QUESTION 23 (2 marks)

Explain the process of tissue culture and its use in agricultural production.

QUESTION 24 (5 marks)

The graph shows changes in the body composition of two steers of different breeds, A and B, at different times during their development.

a) Determine which steer matures earlier. Justify your decision.   *[2 marks]*

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b) Discuss the implications of using an early maturing breed in terms of accessibility to different markets. In your response, propose a solution for producers that allows them to meet different market requirements.

[3 marks]

QUESTION 25 (3 marks)

Identify two features of an online auction in the context of an agricultural industry.

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QUESTION 26 (6 marks)

The graph shows the relationship between average annual income and meat consumption in some Asian countries.
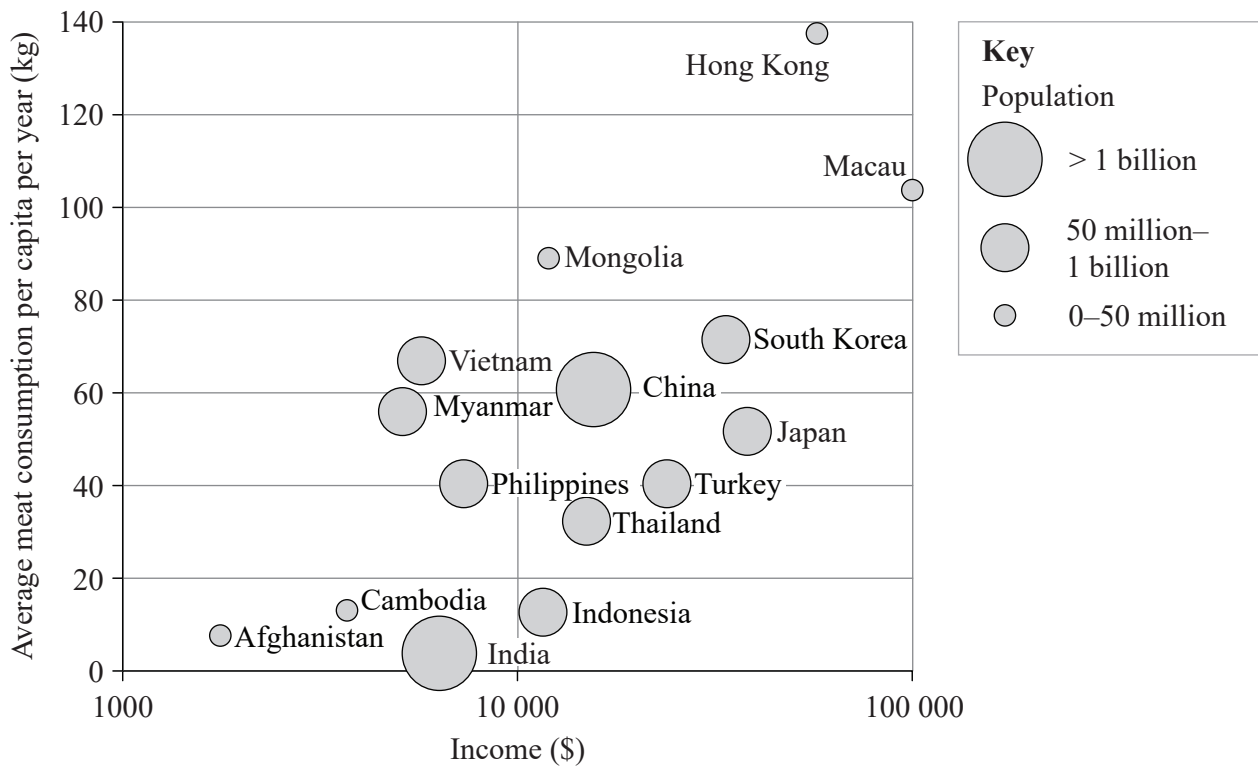
Discuss four opportunities for sustainable social growth in Australian plant and animal protein industries using evidence from the graph. Draw a justified conclusion about the social sustainability of these industries, referring to standard of living.

QUESTION 27 (6 marks)

The graphs show the erosion rate of soil on two blocks of land of varying slopes, one covered in grass and one covered in trees and shrubs.

Grass

Trees and shrubs
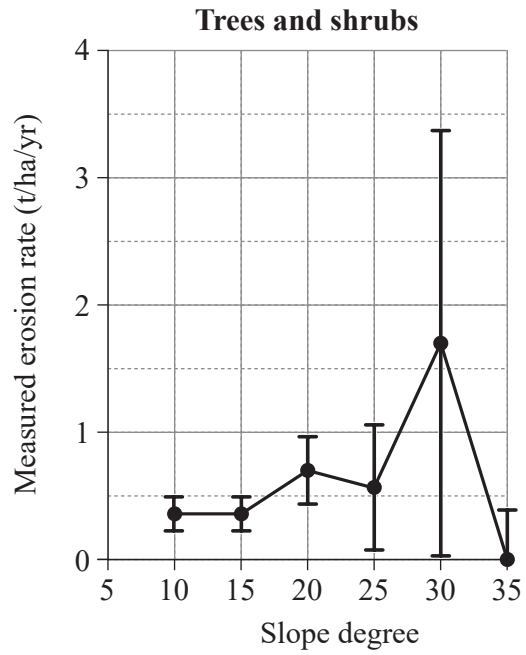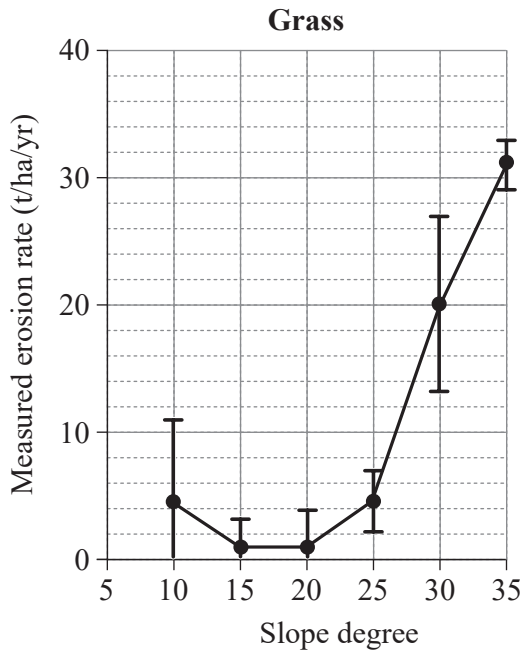
a) Identify differences in the erosion rate of soil on the two blocks of land.   *[2 marks]*

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The graph shows a cross-section of land for an animal production area.
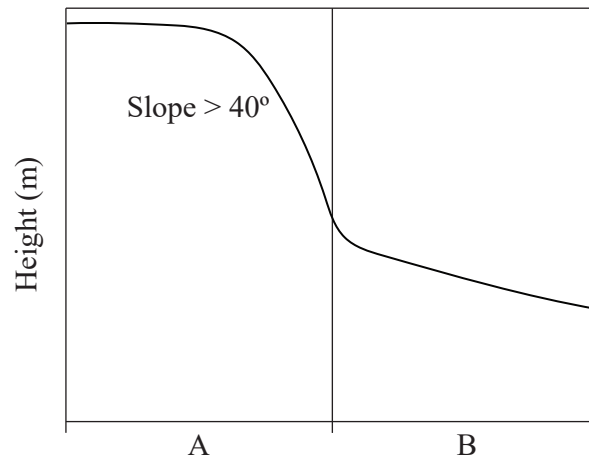
b) Using the data from Question 27a), decide whether grass or trees and shrubs would be more suitable for sustainable animal production on sections A and B. Justify your conclusions.

[4 marks]

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END OF PAPER

ADDITIONAL PAGE FOR STUDENT RESPONSES

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References

Question 21

Data sourced from Graph 1 from Strauss, J 2017, 'Why crop rotation is important in wheat production', *Grain SA*, www.grainsa.co.za/why-crop-rotation-is-important-in-wheat-production.

Question 22

Data derived from Making More From Sheep 2023, 'Tool 3.5: MSA production guidelines for lamb and sheepmeat', www.makingmorefromsheep.com.au/market-focussed-lamb-and-sheepmeat-production/tool_3.5.html.

Question 26

Adapted from Our World in Data 2017, 'Meat consumption vs. GDP per capita, 2017', https://ourworldindata.org/grapher/meat-consumption-vs-gdp-per-capita?time=2017. Used under the Creative Commons Attribuiton 4.0 licence (CC BY 4.0). Source data from Food and Agriculture Organization of the United Nations; data compiled from multiple sources by World Bank.

Question 27

Adapted from Figure 4 in Zhao, J, Van Oost, K, Chen, L, & Govers, G 2016, 'Moderate topsoil erosion rates constrain the magnitude of the erosion-induced carbon sink and agricultural productivity losses on the Chinese Loess Plateau', *Biogeosciences*, vol. 13, pp. 4735–4750, https://doi.org/10.5194/bg-13-4735-2016. Used under the Creative Commons Attribution 3.0 Licence (CC BY 3.0).

External assessment 2022

Agricultural Science

Paper 2

Time allowed

• Perusal time — 10 minutes

• Working time — 90 minutes

General instructions

• Answer all questions in the question and response book.

• Type responses in text fields.

• QCAA-approved calculator permitted.

• Planning paper will not be marked.

Section 1 (34 marks)

• 8 short response questions

Section 2 (17 marks)

• 1 extended response question

Queensland
Government

QCAA Queensland Curriculum
& Assessment Authority

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, type the question number you are responding to.
  - Type 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 eight questions and is worth 34 marks.

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QUESTION 1 (4 marks)

White spot disease (WSD) is caused by a highly contagious viral infection that affects crustaceans such as prawns, lobsters and crabs. The virus that causes WSD poses no risk to food safety or human health but when found in high production areas, like prawn farms, it causes rapid animal death.

WSD is spread by the movement of infected animals or contaminated water. Birds that feed on infected animals and move to another location can readily spread the disease. Fin fish do not carry the disease and are not affected by it.

WSD was first identified in prawn farms and following a 4-year extensive eradication and monitoring program, was no longer detected in the local environment.

Explain two strategies that could be implemented to reduce the incidence of WSD if it is detected again.

QUESTION 2 (4 marks)

a) Explain why beef producers choose to use hormone growth promotants (HGPs).

[2 marks]

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The graph shows the effects of HGPs on three aspects of meat quality in cattle.
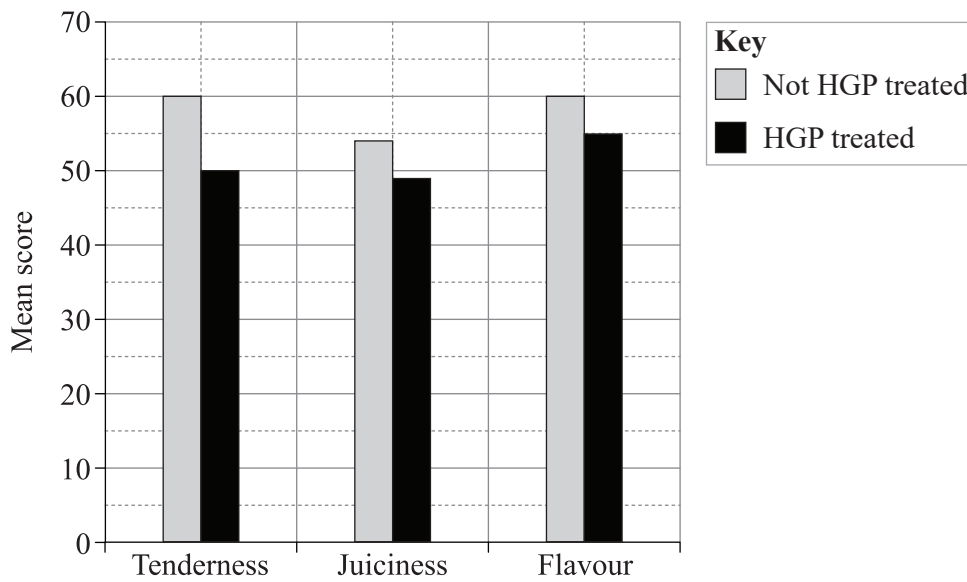
b) Draw a conclusion about the overall effect of HGPs on meat quality. Justify your conclusion using evidence from the graph.

[2 marks]

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QUESTION 3 (4 marks)

The graph shows the yield of five wheat varieties grown under differing levels of salinity. Bars represent 3-year mean grain yield values along with standard error.
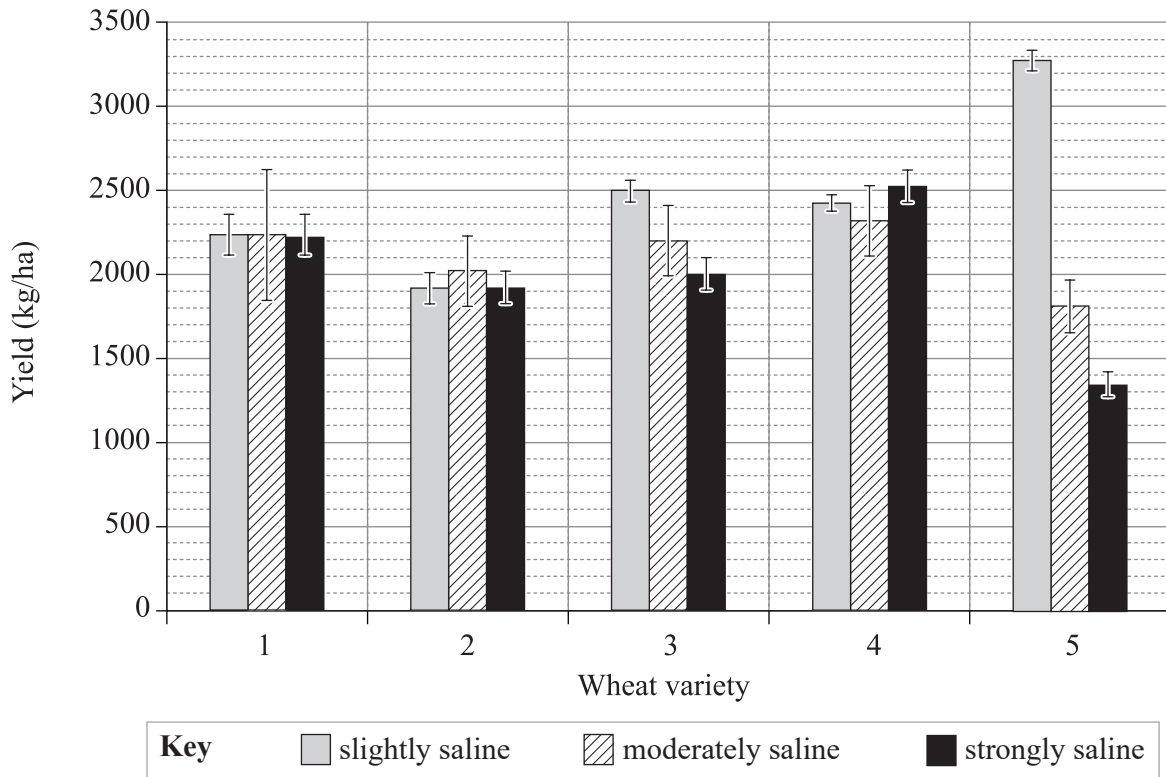
a) Contrast the levels of uncertainty in the data collected from moderately and strongly saline soils. Show your reasoning using evidence from the graph.

[2 marks]

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b) Infer whether variety 1 is the best option to plant in strongly saline soils. Justify your answer using evidence from the graph. *[2 marks]*

QUESTION 4 (5 marks)

The graph shows the effect of different preservative treatments on the shelf life of radish.
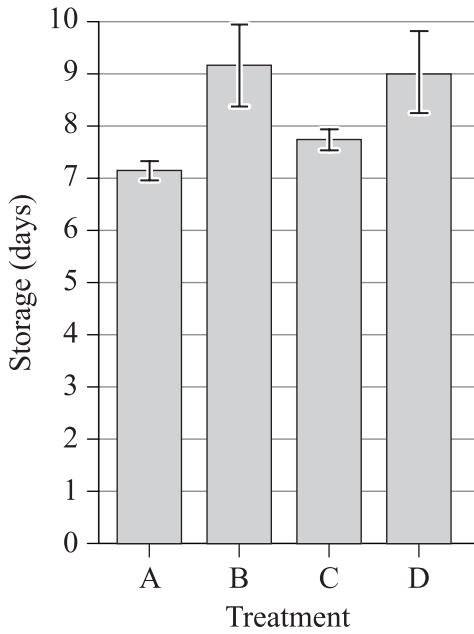
Treatment A	Control
Treatment B	0.6% calcium nitrate
Treatment C	0.6% humic acid
Treatment D	0.6% calcium nitrate and 0.6% humic acid

a)   Identify differences between each of the treatments used.   *[3 marks]*

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b) Identify a negative effect of using preservatives on radish crops, and explain the
    potential effect on consumer satisfaction.   *[2 marks]*

QUESTION 5 (3 marks)

Some egg producers use battery or caged chickens to produce eggs.

    a)   Identify an ethical issue with this type of production. *[1 mark]*

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    b)   Identify a welfare issue with this type of production. *[1 mark]*

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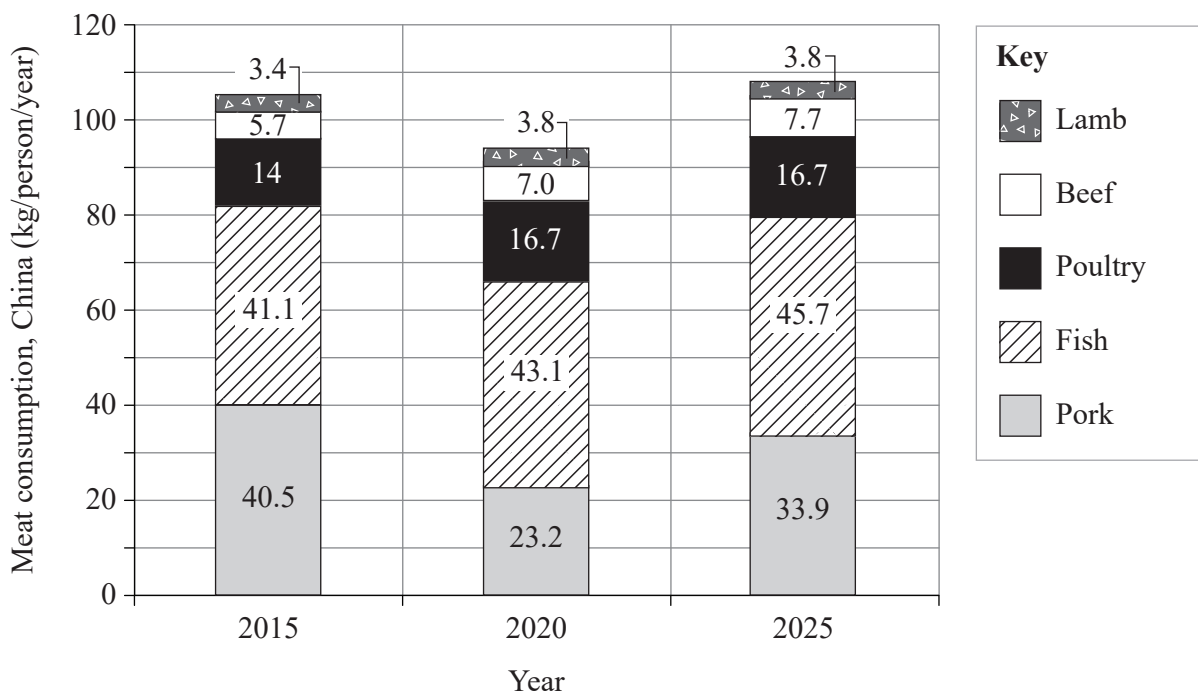   c)   Explain the difference between ethical and welfare issues. *[1 mark]*

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QUESTION 6 (4 marks)

Explain two ways a natural resource is influenced by land clearing.

QUESTION 7 (7 marks)

African swine fever (ASF) has had an impact on animal production in countries where it is prevalent. In 2019, 10% of the total pig population in China, an estimated 44 million pigs, died of ASF.

The first graph shows pork consumption per person in various countries, and the second graph shows current and projected levels of pork consumption per person compared to other animal protein sources in China.

a) Draw conclusions about the effect of ASF on protein availability in China. Justify your conclusions. *[4 marks]*

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b) Discuss three impacts that ASF would have on the pig industry in Australia if it was identified in local piggeries. *[3 marks]*

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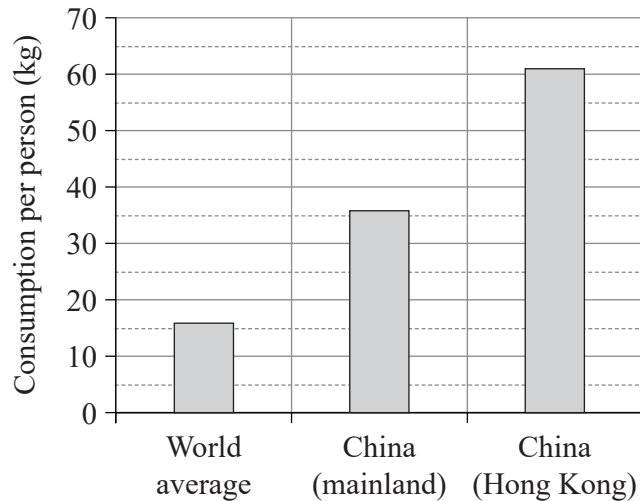
QUESTION 8 (3 marks)

A plant trial was conducted to assess the effect of different amounts of fertiliser on the mean weight of corn produced.
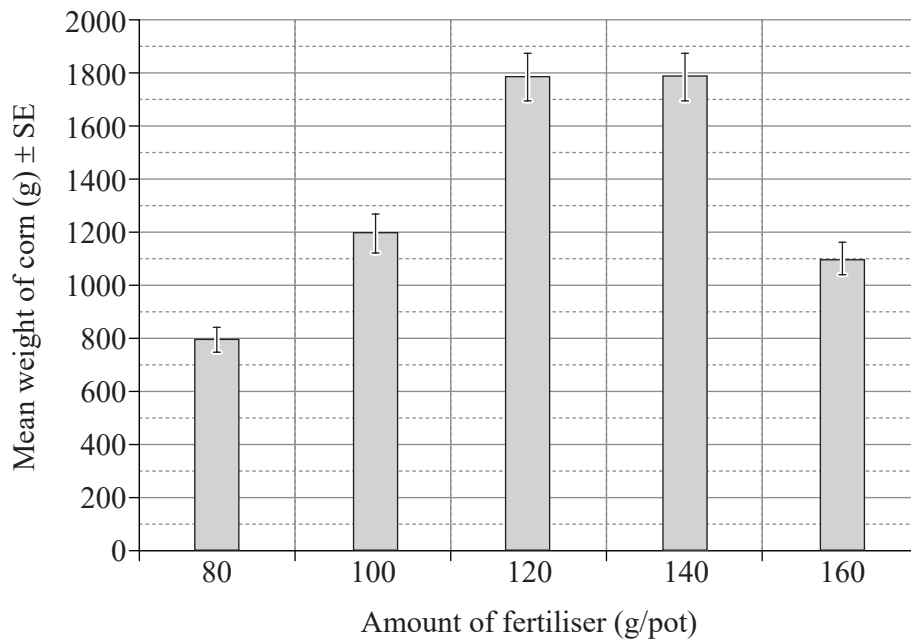
Identify the relationships shown between the amount of fertiliser and mean weight of corn produced.

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Section 2

Instructions

- Select **one** question.
- Indicate the question you have selected by filling in the bubble on the next page completely.
- If you change your mind or make a mistake, draw a cross through the bubble you wish to change and fill in the new bubble completely.

  Example:

Question 9 ●	**Question 10** ✖

- This section has one question and is worth 17 marks.
- Respond in 300–350 words.

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QUESTION 9 (17 marks)

An extensive cattle grazing property in northern Queensland focuses on breeding and backgrounding Brahman and Brahman cross animals for domestic and live export markets. Breeder numbers have declined in recent years due to drought.

The property is 45 000 hectares and has an average annual rainfall of 495 mm.

The current workforce consists of a property manager, a head stockperson and eight recent school leavers working as jackaroos and jillaroos. Contract helicopter pilots are employed twice a year to help with mustering.

An anticipated risk to this Australian agricultural enterprise is drought. Identify one other anticipated risk. For each risk, use the PPRR (Prevention, Preparedness, Response, Recovery) model to describe a risk management strategy for each element of the model. Justify the risk management strategy for each element.

OR

QUESTION 10 (17 marks)

A citrus orchard in Queensland grows Imperial mandarins for the domestic market and Honey Murcott mandarins for the export market. They also have a small number of other citrus trees and sell the fruit through a driveway stall and the local supermarket.

The property occupies an undulating sloped area of 100 hectares and has an average annual rainfall of 870 mm.

Less than half of the property is currently used for producing citrus and the remainder is unused, including some river flats and hillier country. Citrus production on this property has been affected by an outbreak of citrus canker in the past.

The orchard's workforce comprises two owners who live and work full-time at the property, and one full-time employee. They require additional seasonal labour to assist at harvest times.

An anticipated risk to this Australian agricultural enterprise is cyclones. Identify one other anticipated risk. For each risk, use the PPRR (Prevention, Preparedness, Response, Recovery) model to describe a risk management strategy for each element of the model. Justify the risk management strategy for each element.

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END OF PAPER

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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.

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ADDITIONAL PAGE FOR STUDENT RESPONSES

Write the question number you are responding to.

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References

Question 2

Data sourced from

Australian Brahman Breeders' Association 2009, 'Hormonal Growth Promotants and Meat Quality', *Brahman News*, vol. 164, Figure 2, Consumer panel scores for LD muscle, www.brahman.com.au/technical_information/meatScience/hormonalGrowth.html.

Question 3

Data sourced from

Figure 1 in Qadir, M, Tubeileh, A, Javaid, A & Khan, MA 2008, 'Productivity enhancement of salt-affected environments through crop diversification', *Land Degradation and Development*, vol. 19, no. 4, pp. 429–453, www.researchgate.net/figure/Field-scale-evaluation-of-salt-tolerant-wheat-varieties-SARC-1-SARC-2-SARC-3-and_fig1_227602864.

Question 4

Data sourced from

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Question 7

Data and information derived from

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Figure 4 in Food and Agriculture Organization of the United Nations 2017, 'African Swine Fever threatens People's Republic of China (6 March 2018)', *FAO Animal Health Risk Analysis – Assessment*, vol. 5, www.fao.org/3/i8805en/i8805en.pdf