External assessment

Agricultural Science

Paper 1

General instruction

- Work in this book will not be marked.

Section 1

QUESTION 1

Identify the hormone that causes cell elongation in plants.

(A) auxin

(B) ethylene

(C) gibberellin

(D) abscisic acid

QUESTION 2

The most important function of microscopic organisms in a ruminant digestive system is the

(A) digestion of fat.

(B) digestion of cellulose.

(C) synthesis of vitamin A.

(D) absorption of amino acids.

QUESTION 3

Legume pasture species can support sustainable plant production by

(A) increasing groundwater recharge.

(B) improving soil structure/porosity.

(C) removing excessive sodium from the topsoil.

(D) improving potassium availability in soil for plant use.

QUESTION 4

The diagram shows the different processes that take place in the carbon cycle.
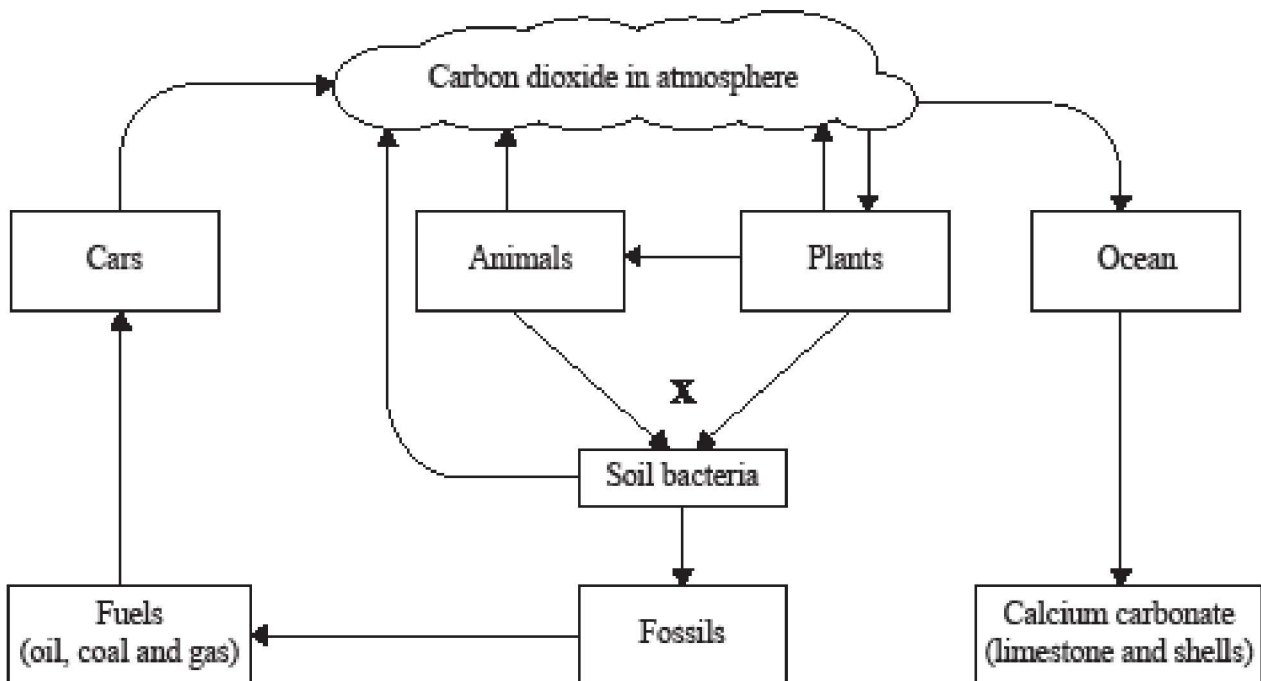
Identify the process taking place at point **X**.

(A)   decomposition

(B)   fossilisation

(C)   respiration

(D)   feeding

QUESTION 5

The table shows part of the nutritional analysis for four different pig rations.

Component	Ration A	Ration B	Ration C	Ration D
Protein (%)	20	16	22	16
Calcium (%)	0.9–1.2	0.8–1.4	1.0–1.3	1.0–1.4
Digestible energy (DE) (MJ/kg)	14.5	12.8	16.0	13.2

Use the table to identify the most appropriate ration for non-lactating sows.

(A) Ration A

(B) Ration B

(C) Ration C

(D) Ration D

QUESTION 6

The graph shows the price and domestic supply of avocados between 2011 and 2018.
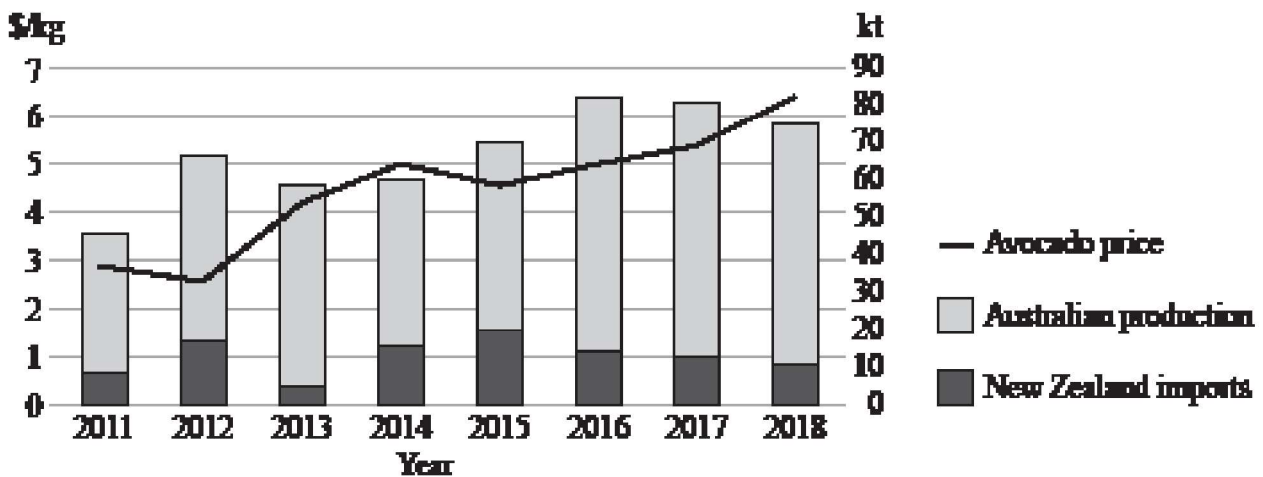
The change in the price of avocados between 2013 and 2014 is most likely due to

(A) a decrease in the demand for avocados.

(B) an increase in the demand for avocados.

(C) a slight increase in the overall supply of avocados.

(D) an increase in the supply of cheap avocados from New Zealand.

QUESTION 7

Commercial fishing from native fisheries must be sustainable to continue. The graph shows the commercial catch of a marine species from a native fishery, measured in tonnes (t), from 2008 to the end of 2017.
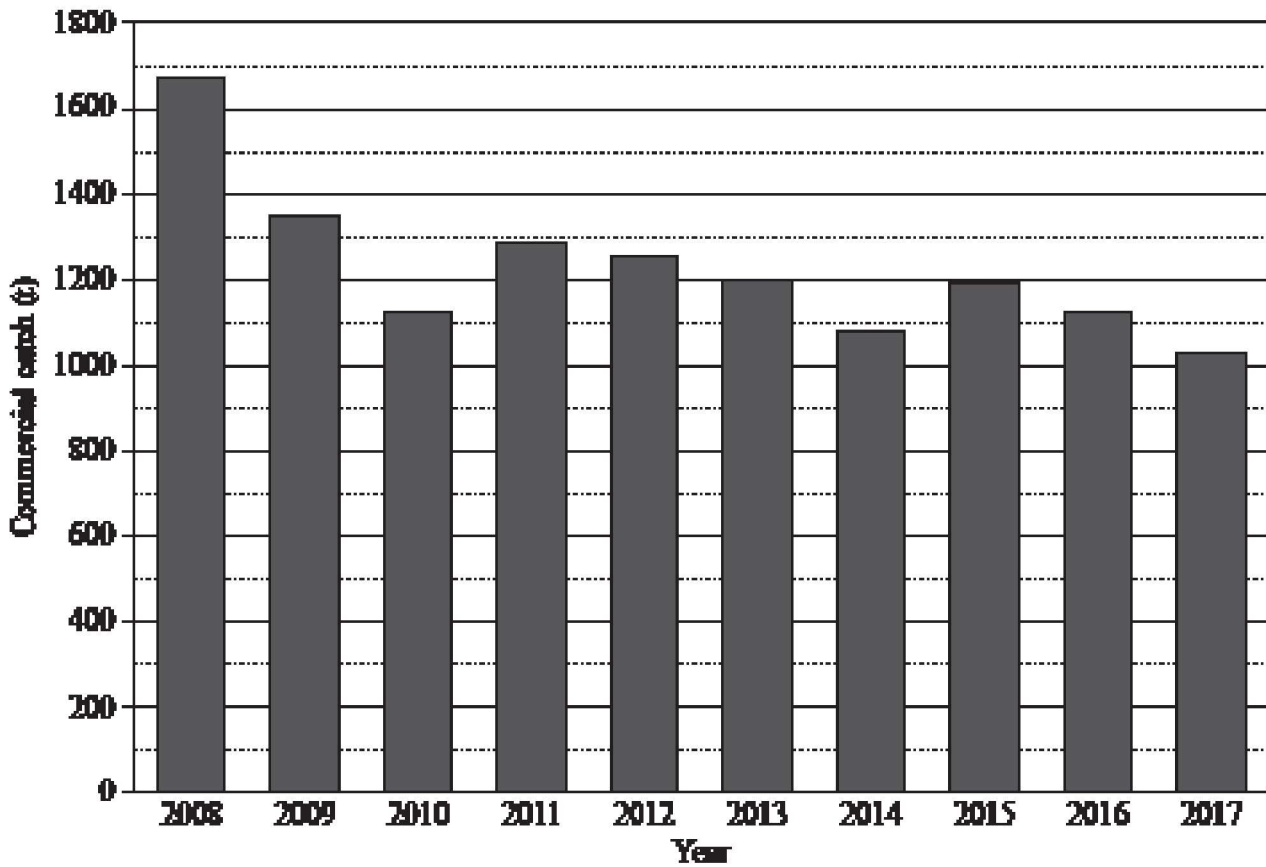
Which of the following options represents the approximate average annual decrease in commercial catch between the start of 2008 and end of 2017?

(A)   41 tonnes

(B)   55 tonnes

(C)   65 tonnes

(D)   72 tonnes

QUESTION 8

The table shows the annual sources of income from the sale of animals for a fat lamb enterprise.

Source	Sales	Price per head	Cartage (%)
Ewes	50	$165	1.5
Wethers	235	$105	1.5
Lambs	365	$144	1.0

Determine the gross annual income of the enterprise.

(A) $52 560

(B) $77 235

(C) $84 465

(D) $85 485

QUESTION 9

Which part of the PPRR model of risk management best demonstrates a producer's decision to sell non-breeders during a drought?

(A) prevention

(B) preparedness

(C) response

(D) recovery

QUESTION 10

The table shows catalogue EBV information for two rams of the same breed at a sale.

	Litter size	8-week weight	Maternal	Scan weight	Muscle depth	Fat depth	Index
Ram 1 EBV	0.30	4.39 kg	0.02 kg	10.36 kg	5.11 mm	0.51 mm	361
Accuracy %	51	94	46	94	90	94	75
Ram 2 EBV	0.17	5.79 kg	−0.90 kg	12.34 kg	2.24 mm	0.17 mm	310
Accuracy %	45	89	31	94	91	91	92

Ram 1 would be the preferred sire for a producer to use if they wanted to breed better ewes and finish lambs over a longer period because

(A) Ram 1 has a higher maternal EBV than Ram 2.

(B) Ram 1 has higher muscle and fat depth EBVs than Ram 2.

(C) lambs will still have a respectable growth rate compared to lambs produced from Ram 2.

(D) ewe lambs retained for breeding would produce more lambs and grade better at slaughter.

QUESTION 11

The supply of an agricultural product is most directly affected by the

(A) amount of household disposable income.

(B) number of people wanting the product.

(C) market price offered for a product.

(D) price of alternative products.

QUESTION 12

A disease control program for an agricultural animal follows the timeline shown in the graph.

This stimulus has not been published for copyright reasons.

View diagram 'Two doses of vaccine plus boosters are essential' in Zoetis 2018,
'Best practice vaccination for lambs',
www.zoetis.com.au/livestock-solutions/sheep/maximise-lamb-productivity/best-practice-vaccination-for-lambs.aspx.

Which of the following options best describes the point labelled X on the graph?

(A) the highest level of protective antibodies for the animal

(B) the animal is susceptible to infection by identified microbial disease

(C) immunity levels are rising in the young animal 12 months after birth

(D) maternal antibodies are providing the animal with sufficient immunity

QUESTION 13

The table identifies the minimum requirements for different lamb export markets.

Market segment	Liveweight range (kg)	Carcass weight range (kg)	Preferred fat score
Heavy export	38–64	20–30	2 to 4
Light export	25–35	10–16	2
'Hajj' market	35–41	18–22	No preference

Identify the lamb that is best suited to the heavy export market.

Lamb	Liveweight (kg)	Carcass weight (kg)	Fat score
(A)	50	27	1
(B)	40	23	5
(C)	40	22	3
(D)	35	19	2

QUESTION 14

Vitamins are important for a six-week-old calf because they

(A) stimulate the functioning of the rumen.

(B) ensure normal fat digestion.

(C) improve feed efficiency.

(D) support fertility.

QUESTION 15

The table shows livestock's approximate tolerances to dissolved salts in drinking water.

Livestock	No adverse effects (g/L)	Reluctance to drink (g/L)	Decline in condition and health (g/L)
pigs	0–1.0	1.0–5.0	5.0–7.0
horses	0–4.0	4.0–6.0	6.0–7.0
beef cattle	0–4.0	4.0–5.0	5.0–10.0
dairy cattle	0–2.4	2.4–4.0	4.0–7.0

Identify the livestock that would suffer a loss in production with a total dissolved salt measurement of 4820 mg/L.

(A) pigs

(B) horses

(C) beef cattle

(D) dairy cattle

QUESTION 16

Identify the organisms that can cause a metazoal disease.

(A) barber's pole worm, buffalo flies and cattle ticks

(B) tapeworms, liver flukes and clostridial bacteria

(C) clostridial bacteria, roundworms and lice

(D) stickfast fleas, cattle ticks and ringworm

QUESTION 17

An experiment was conducted to compare the effects of different fertiliser treatments on the fruit yield of apple trees. Each fertiliser treatment was made up of a base of nitrogen, phosphorus and potassium (NPK) and a combination of mineral or organic material.

The table shows the mean values $\pm$ confidence interval (CI) at 95% level.

Fertiliser treatment	Yield per tree (kg)
NPK + zeolite	22.6 ± 0.6
NPK + cattle manure	23.7 ± 0.4
NPK + chicken manure	23.5 ± 0.3
NPK + zeolite + cattle manure	21.0 ± 1.0

The conclusion supported by the data is

(A) NPK + cattle manure significantly increased yield per tree compared with NPK + zeolite.

(B) NPK + chicken manure significantly increased yield per tree compared with NPK + cattle manure.

(C) NPK + zeolite + cattle manure significantly increased yield per tree compared with NPK + chicken manure.

(D) NPK + cattle manure significantly increased yield per tree compared with the other fertiliser treatments.

QUESTION 18

Identify the genetic technique used to naturally combine desirable genes found in two or more different plant varieties to produce superior pure-breeding offspring.

(A) grafting

(B) hybridisation

(C) tissue culture

(D) genetic modification

The tables contain a nutrient analysis for different animal feeds and the minimum recommended crude protein for sheep at different stages of development.

Animal feed	Metabolisable energy (MJ/kg dry matter)	Crude protein (%)	Dry matter (%)
Wheat grain	13	12	90
Sorghum grain	13	11	90
Chickpeas	12	21	90
Grassy lucerne	9	13	90
Immature grass pasture	11	8	20
Cottonseed meal	10	33	90
Molasses	13	1	76

50-kg sheep	Minimum crude protein requirement (%)
Dry sheep	6–8
Ewe — mid-pregnancy	8–10
Ewe — early lactation	12–14

QUESTION 19

Feed sources that could be used to meet the crude protein requirement for a ewe that has lambed are

(A)   molasses, grassy lucerne and wheat grain.

(B)   wheat grain, grassy lucerne and chickpeas.

(C)   sorghum grain, chickpeas and immature grass pasture.

(D)   sorghum grain, cottonseed meal and immature grass pasture.

QUESTION 20

To supply approximately 47 MJ metabolisable energy and 0.51 kg crude protein, on a dry matter basis, to animals that will be introduced to a feedlot for a short period of time and are expected to eat 5 kg a day, an appropriate ration is

(A) 4 kg wheat grain + 1 kg chickpeas.

(B) 3 kg wheat grain + 2 kg chickpeas.

(C) 3 kg grassy lucerne + 2 kg wheat grain.

(D) 4 kg immature grass pasture + 1 kg wheat grain.

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References

Question 4

Adapted from MC Biology 2008, 'Carbon cycle', *Environmental Biology — Ecosystems*, http://w3.marietta. edu/~biol/biomes/ecosystems.htm.

Question 5

Riverina 2015, *Pig Breeder Pellets/Meal*, www.riverina.com.au/products/pig-breeder-pellets-meal.

Question 6

Xia, C 2019, 'Commodity outlook and issues: Wide Bay agriculture' (PowerPoint presentation), Australian Bureau of Agricultural and Resource Economics and Sciences (ABARES), 6 August, www.agriculture.gov. au/sites/default/files/abares/documents/conference-events/regional-outlook/bundabergregional-xia.pdf Used under a Creative Commons Attribution 4.0 International licence (CC BY 4.0).

Question 7

Adapted from Fisheries Research and Development Corporation 2018, Spanner Crab, www.fish.gov.au/ report/178-Spanner-Crab-2018. Licensed under a Creative Commons Attribution 3.0 licence (CC BY 3.0).

Question 12

Adapted from Zoetis 2018, 'Best practice vaccination for lambs', www.zoetis.com.au/livestock-solutions/ sheep/maximise-lamb-productivity/best-practice-vaccination-for-lambs.aspx.

Question 13

Top table sourced from 'Module 3: Market focused lamb and sheepmeat production', Making More From Sheep, http://www.makingmorefromsheep.com.au/market-focussed-lamb-and-sheepmeat-production/ tool_3.2.html (c) Australian Wool Innovation and Meat and Livestock Australia 2008. Used with permission.

Question 15

Department of Primary Industries and Regional Development (WA) 2020, 'Water quality for livestock', *Agriculture and Food*, www.agric.wa.gov.au/livestock-biosecurity/water-quality-livestock.

Question 17

Milosevic, T & Milosevic, N 2015, 'Apple fruit quality, yield and leaf macronutrients content as affected by fertilizer treatment', *Journal of Soil Science and Plant Nutrition*, vol. 15, no. 1, pp. 76–83.

Questions 19 and 20

Australian Wool Innovation and Meat and Livestock Australia 2008, *Making More From Sheep*, 'Module 11: Healthy and contented sheep', http://makingmorefromsheep.com.au/healthy-contented-sheep/tool_11.1.htm.

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School name ☐

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barcode ID label here

Book ☐ of ☐ books used

External assessment

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 (44 marks)

- 10 short response questions

Queensland Government | QCAA Queensland Curriculum & Assessment Authority

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.	○	○	○	○
14.	○	○	○	○
15.	○	○	○	○
16.	○	○	○	○
17.	○	○	○	○
18.	○	○	○	○
19.	○	○	○	○
20.	○	○	○	○

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 10 questions and is worth 44 marks.

QUESTION 21 (4 marks)

Use an example to explain the process that an agricultural plant product undergoes between harvest and sale to the consumer.

QUESTION 22 (4 marks)

A producer has a 10-ha paddock with 2000 kg DM/ha of feed available.

Calculate the number of 300-kg steers the producer could run in the paddock for 25 days. Assume these steers have a pasture intake of 10 kg DM/head/day and that pastures should be destocked to prevent over-grazing when they are at a mass of 1000 kg green DM/ha. Show your working.

QUESTION 23 (6 marks)

Foot and mouth disease (FMD) is a severe, highly contagious disease of cloven-hoofed animals such as cattle, sheep and pigs.

The most common signs of FMD are fluid-filled blisters and ulcers in the mouth and on the feet, lameness, excessive salivation, and loss of appetite.

There is no specific treatment for FMD. If an outbreak were to occur in Australia, movement control measures would need to be initiated. All infected animals would need to be destroyed.

Draw three conclusions about the impact of an FMD outbreak on Australian livestock industries. Provide reasoning to support each of your conclusions.

QUESTION 24 (4 marks)

A cattle producer has a creek running through their property. The creek provides water for cattle and the irrigation of fodder crops and improved pastures to boost animal production. After experiencing a year with significantly less than average rainfall, the producer notices that native vegetation along the creek bank is dying off, the creek water is more discoloured than usual, and the leaves in the fodder crops and improved pastures are yellowing.

Explain two strategies the producer could implement to reverse the processes that are occurring on the property.

QUESTION 25 (4 marks)

The table contains mean values for feed intake, feed conversion ratio, average daily weight gain and end-of-trial fat depth of feedlot lambs that were given feeds formulated at different energy levels.

Feed	Intake (kg/day)	Feed conversion ratio	Average daily gain (g/day)	Fat depth (mm)
Low energy	2.3 ± 0.5	5.1 ± 0.6	476 ± 30.0	6
Medium energy	1.8 ± 0.9	4.1 ± 0.5	512 ± 30.1	11
High energy	1.7 ± 0.3	3.9 ± 0.6	528 ± 31.4	15

Contrast the results of using the different feeds. Draw conclusions about the best feed for fat lamb production.

QUESTION 26 (4 marks)

a) What is a tariff?   *[1 mark]*

_____

_____

_____

b) What is a free trade agreement?   *[1 mark]*

_____

_____

_____

c) Explain why the European Union (EU) currently has a tariff on Australian lamb and beef.   *[1 mark]*

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d) Explain the impact that a tariff as high as 50% has on the sale of Australian goods in the EU.   *[1 mark]*

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QUESTION 27 (4 marks)

A trial was conducted to determine the efficacy of treatments for the Varroa mite in honey bees. Four treatments were used: the control, fungus *Metarhizium anisopliae* and pesticides (Product A and Product B). The table shows the mean values for each treatment.

Treatment	Mean values for mite infestation of adult bees (%)		Mean values for mites remaining in the hive after treatment	Honey extracted (kg)
	Before treatment	After treatment		
Control	1.55 ± 0.68	1.93 ± 0.38	56.79 ± 8.59	6
Metarhizium	1.28 ± 0.45	0.32 ± 0.03	21.14 ± 4.79	9
Product A	0.87 ± 0.01	0.02 ± 0.01	0.71 ± 0.10	12
Product B	0.92 ± 0.05	0.03 ± 0.01	0.81 ± 0.15	14

Use the table to draw a conclusion about the most effective treatment for the control of the Varroa mite in honey bees. Provide three pieces of evidence from the data to support your conclusion.

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QUESTION 28 (7 marks)

Mulesing involves the removal of wool-bearing skin from the breech area of a sheep. In 2008, over 95% of wool growers used this technique (without pain relief) to prevent flystrike in their flocks. The graph shows the change in the percentage of wool growers who either do not practise mulesing, ceased mulesing or use pain relief with mulesing. The table shows how long it would take to improve resistance to flystrike in sheep using an alternative method to mulesing.
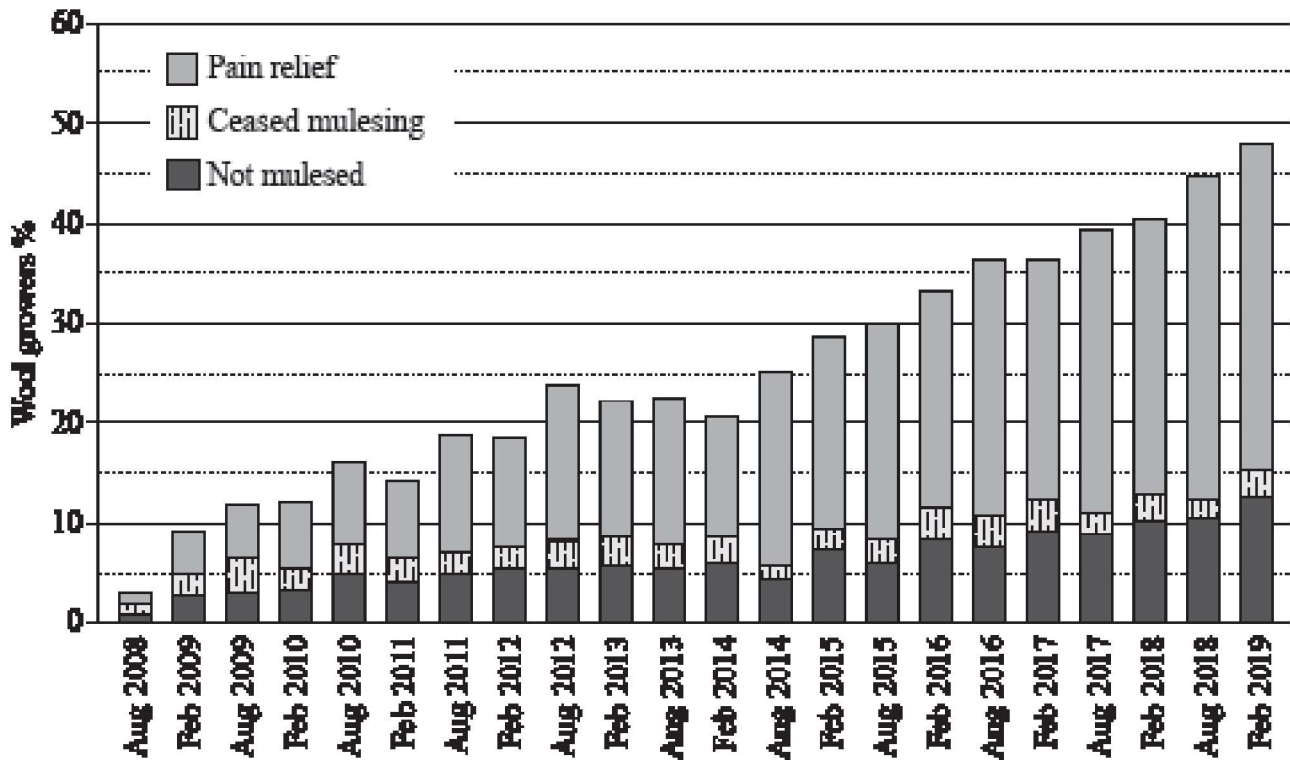
Wrinkle score	Risk	Proportion of flock (%)		
		Start	5 years	10 years
1	Resistant	5	15	30
2	Low risk	24	38	40
3+	At risk	71	47	30

Note: An assessment of wrinkle score will provide an indication of breech flystrike risk. 30% at risk can be culled and maintain a stable flock.

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a) Use the graph to calculate the percentage change in producers who practised mulesing with pain relief between February 2009 and February 2019. Show your working. *[2 marks]*

b) Use the table to identify the alternative method to mulesing. *[1 mark]*

c) Draw a conclusion about how willing wool producers were to adopt this method. Use data to justify your conclusion. *[4 marks]*

QUESTION 29 (4 marks)

The table shows data from a greenhouse trial, which was conducted to compare hydroponic and soil-grown strawberries.

Production	Hydroponic	Soil-grown
Fixed costs	$593.80	$270.59
Variable costs	$47.38	$20.48
Total yield (n)	85	70
Mean mass of individual berries ± SD (g)	5.4 ± 3.0	7.1 ± 3.7
Water use (L)	1363	1968

Analyse the data to determine the best growing medium for strawberries in a market in which the price per kg is 10% higher for hydroponically grown strawberries.

QUESTION 30 (3 marks)

Use an example to explain two benefits for farmers who use genetically engineered crops.

_____

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END OF PAPER

ADDITIONAL PAGE FOR STUDENT RESPONSES

Write the question number you are responding to.

Do not write outside this box.

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ADDITIONAL PAGE FOR STUDENT RESPONSES

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Do not write outside this box.

References

Question 25

Brand, TS, Genis, MP, Hoffman, LC, van de Vyver, WFJ, van der Walt, C & Jordaan, GF, 'Effects of dietary energy content and provision of β-adrenergic agonist on the production of feedlot lambs', *South African Journal of Animal Science*, vol. 43, issue 5, supplement 1, www.scielo.org.za/pdf/sajas/v43s1/27.pdf.

Question 27

Adapted by permission from Springer Nature Customer Service Centre GmbH, Springer Nature *Experimental and Applied Acarology*, 'Efficacy of strips coated with Metarhizium anisopliae for control of Varroa destructor (Acari: Varroidae) in honey bee colonies in Texas and Florida' , Kanga, LHB, Jones, WA & Gracia, C © Springer Science+Business Media B.V. 2006

Question 28

Adapted from FlyBoss 2020, 'Breeding to reduce flystrike susceptibility', www.flyboss.com.au/sheep-goats/breeding-and-selection/breeding-to-reduce-flystrike-susceptibility.php.

Sim, T 2019, 'Animal welfare groups seek new mulesing phase-out from AWI', *Sheep Central*, 15 March, www.sheepcentral.com/animal-welfare-groups-seek-new-mulesing-phase-out-timeline-from-awi.

Question 29

Treftz, C & Omaye, ST 2015, 'Comparison between hydroponic and soil systems for growing strawberries in a greenhouse', *International Journal of Agricultural Extension*, vol. 3, no. 3, pp. 195–200, https://pdfs.semanticscholar.org/d138/1ebcba5802c7d668d4940491857979e4a923.

External assessment

# Agricultural Science

Paper 2

General instruction

• Work in this book will not be marked.

Stimulus 1

The figure demonstrates the agricultural sub-industries in which people are employed.

Most people who worked in agriculture in 2016 were employed as:

• managers (59%; 132 955 people)

• labourers (25%; 56 610 people), including livestock farm workers, crop farm workers and packers

• technicians and trade workers (4.5%; 10 152 people), including nurserypersons, gardeners and shearers.
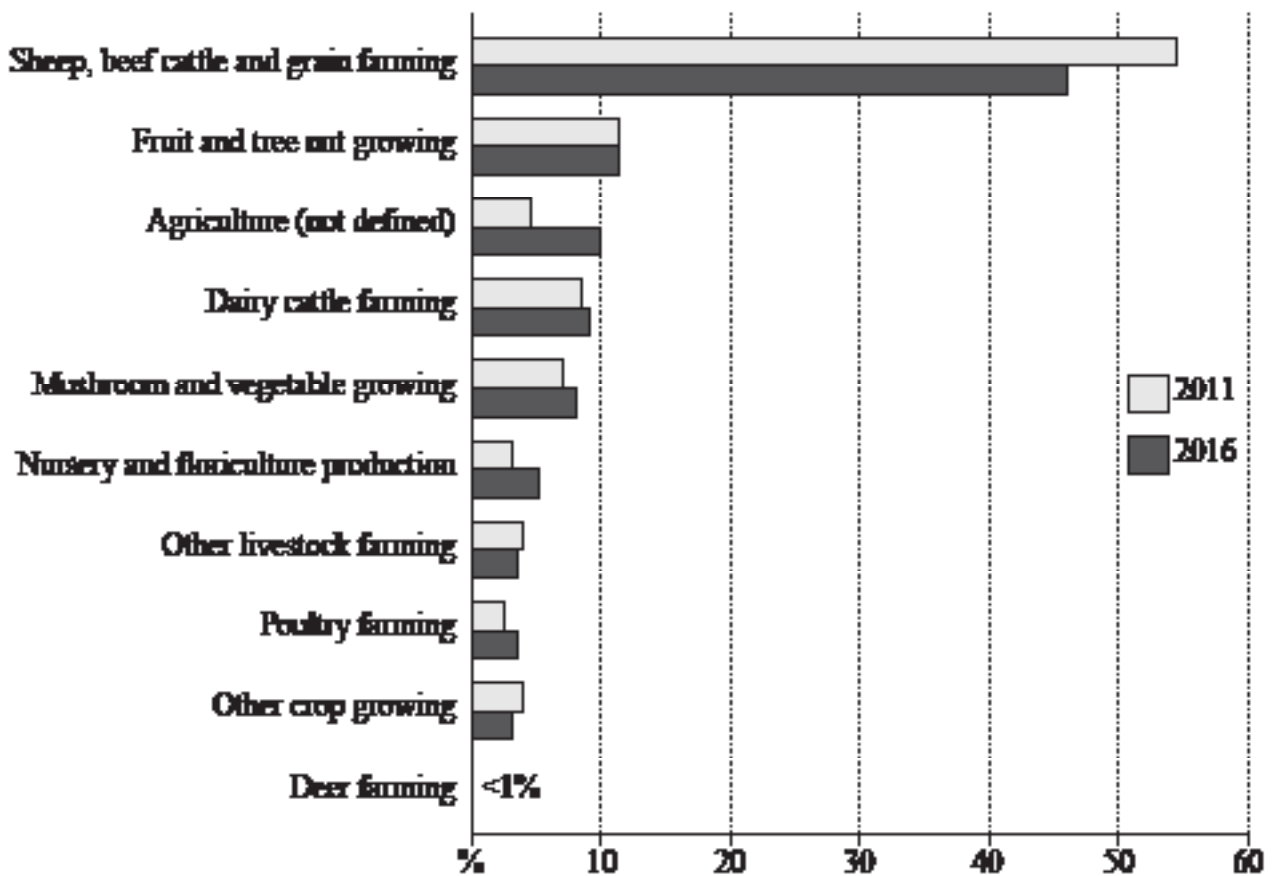
Stimulus 2

The figure identifies the type of employment of the agricultural workforce in 2016.

Stimulus 3

In 2016, itinerant workers made up 11% of the agricultural workforce. This was up from 9% in 2011.

The figure shows the percentage of itinerant workers in 10 agricultural industries in 2016.
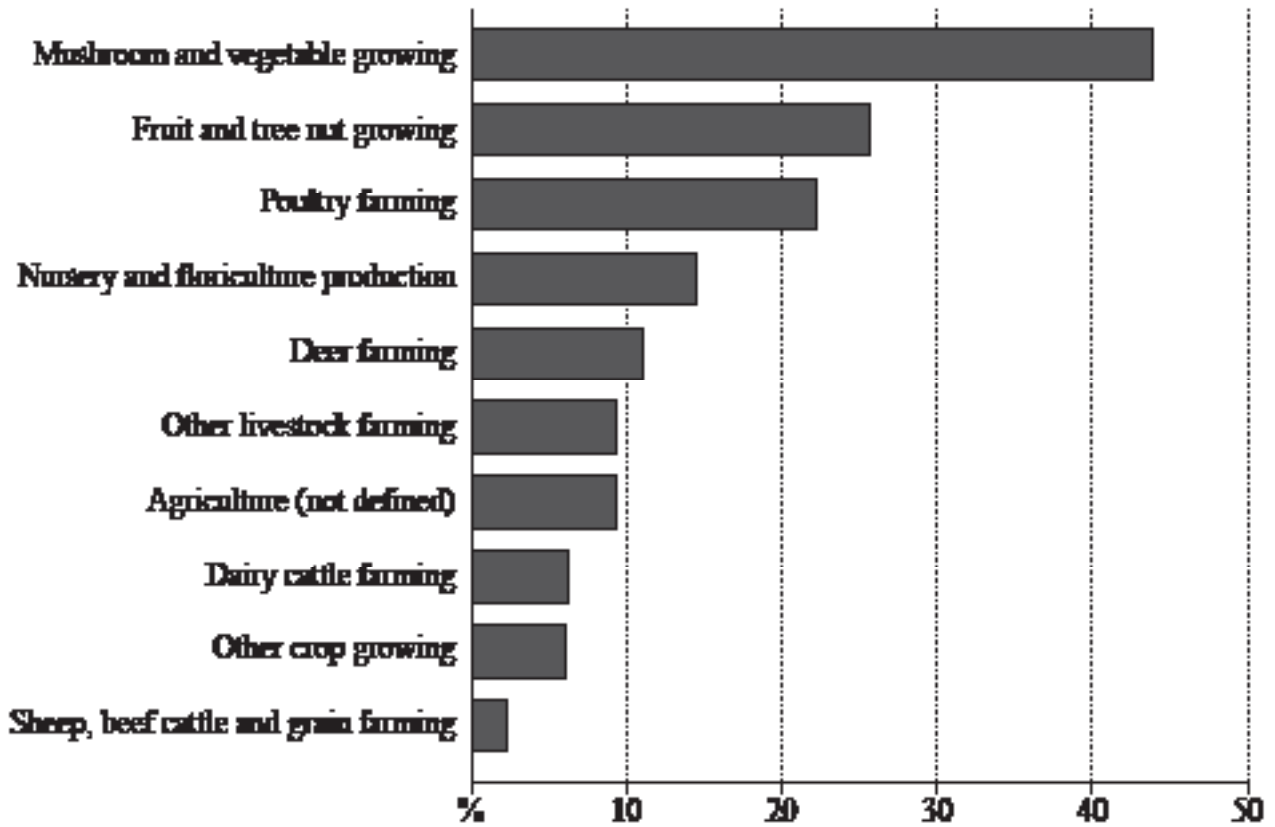
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References

Stimulus 1

Modified from Fig. 14 in Binks, B, Stenekes, N, Kruger, H & Kancans, R 2018, 'Snapshot of Australia's Agricultural Workforce', Australian Bureau of Agricultural and Resource Economics and Sciences (ABARES), Canberra, www.agriculture.gov.au/abares/publications/insights/snapshot-of-australias-agricultural-workforce. Used under a Creative Commons Attribution 4.0 International licence (CC BY 4.0)

Stimulus 2

Fig. 4 in Binks, B, Stenekes, N, Kruger, H & Kancans, R 2018, 'Snapshot of Australia's Agricultural Workforce', Australian Bureau of Agricultural and Resource Economics and Sciences (ABARES), Canberra, www.agriculture.gov.au/abares/publications/insights/snapshot-of-australias-agricultural-workforce. Used under a Creative Commons Attribution 4.0 International licence (CC BY 4.0)

Stimulus 3

Fig. 10 in Binks, B, Stenekes, N, Kruger, H & Kancans, R 2018, 'Snapshot of Australia's Agricultural Workforce', Australian Bureau of Agricultural and Resource Economics and Sciences (ABARES), Canberra, www.agriculture.gov.au/abares/publications/insights/snapshot-of-australias-agricultural-workforce. Used under a Creative Commons Attribution 4.0 International licence (CC BY 4.0)

External assessment

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 (36 marks)

- 9 short response questions

Section 2 (15 marks)

- 1 extended response question

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 nine questions and is worth 36 marks.

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QUESTION 1 (4 marks)

The table shows average Angus herd EBVs for live weight (kg) from 2015 to 2017.

Year	Birth	200 days	400 days	600 days
2015	4.4	+15.7	+28	+35
2016	4.8	+17.4	+35	+45
2017	5.5	⊦23.3	⊦41	⊦51

a)   Determine the change in average 600-day weight from 2015 to 2017.   *[1 mark]*

b)   If the data trends in the table continue, draw conclusions about the impact on the
       Angus breed into the future.   *[3 marks]*

QUESTION 2 (3 marks)

a) Identify an advantage of tissue culture and explain how this can be used in an
    agricultural setting.   *[2 marks]*

_____

_____

_____

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_____

b) Describe the genetic relationship between the original plant and the new plant in the
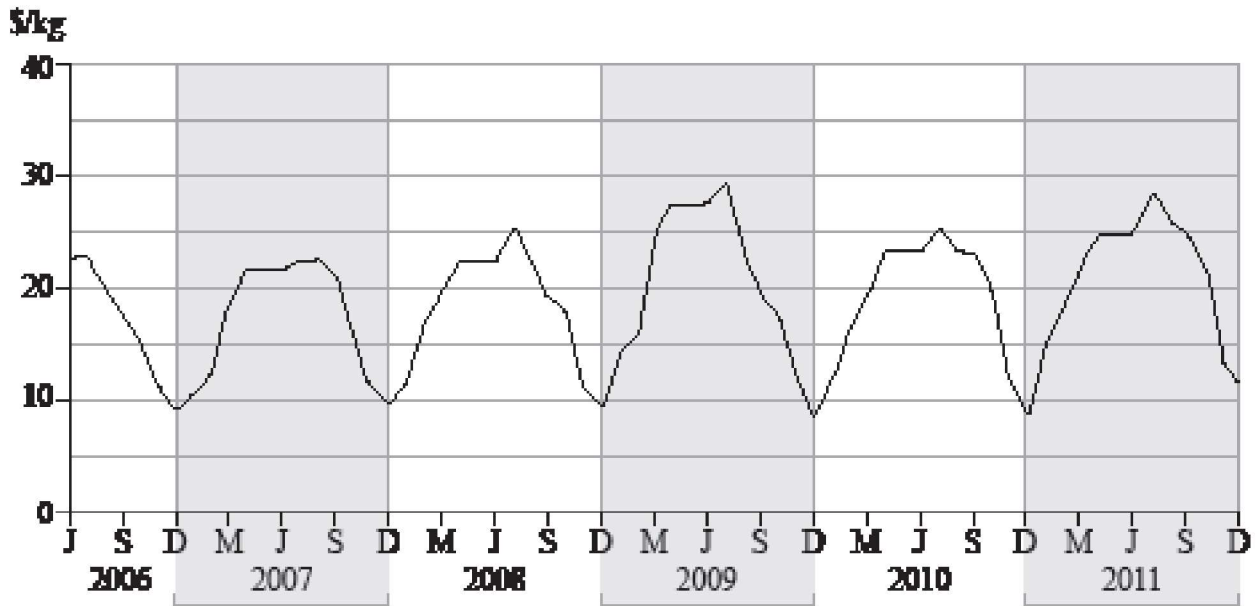   process of tissue culture.   *[1 mark]*

_____

_____

QUESTION 3 (3 marks)

The graph shows the domestic price of strawberries in New Zealand from June (J) 2006 to December (D) 2011.

a)   Determine the change in domestic price between December 2008 and March (M) 2009.   *[1 mark]*

_____

_____

b)   Identify the season likely to see the greatest supply of strawberries. Provide a reason
     for your decision.   *[2 marks]*

_____

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_____

QUESTION 4 (4 marks)

The table shows the results of an experiment that compared varieties of canola for oil production and yield.

The current base price for canola is $592 per tonne. A 1.5% premium is paid for every 1% of oil content above 42%. A 1.5% discount is applied for every 1% of oil content below 41%.

	Variety 1	Variety 2	Variety 3
Oil content (%)	42.73	45.65	39.32
Yield (t/ha)	1.87	1.76	2.12

Draw a conclusion about which canola variety should be selected for commercial production.
Show your working.

QUESTION 5 (4 marks)

Identify two plant pests or diseases that are significant for plant industries. Describe why each pest or disease is a major issue for its respective industry.

Plant pest/disease 1: _____

_____

_____

_____

Plant pest/disease 2: _____

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_____

_____

QUESTION 6 (3 marks)

a) Explain one reason for a producer to clear land on their property. *[1 mark]*

_____

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b) Describe one short-term effect and one long-term effect land clearing may have on the soil. *[2 marks]*

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QUESTION 7 (4 marks)

An experiment was conducted to determine the effect of spraying different concentrations of a hormone on the maturation of different apple varieties.

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View at https://bibanez.weebly.com/uploads/2/2/6/7/22671312/780953_orig.png

a) Identify the plant hormone that was applied to the apples. Explain the effect this hormone has on apple maturation time using evidence from the graph. *[2 marks]*

b) Identify the optimum concentration of hormone that should be applied to Golden apples. Provide reasoning to support your decision. *[2 marks]*

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QUESTION 8 (6 marks)

Two groups of sheep were grown under different management strategies. One group was weaned at 4 months and sent to the abattoir. The second group was weaned at 3 months and then fed on grain for 40 days before being sent to the abattoir.

The tables show the results for each of the management strategies and the minimum requirements for different lamb markets.

Group	Management strategy	Average birthweight (kg)	Daily weight gain (kg/day)	Final fat depth (mm)	Dressing percentage (%)
1	Weaned after 120 days	4.25	0.25	9	43
2	Weaned after 90 days Fed grain for 40 days	4.5	Before weaning: 0.25 On grain: 0.40	11	44

Market	Carcass weight (kg)	Fat depth (mm)	Grain feeding permitted
Supermarket lamb	18–22	6–15	No
Food service lamb	20–25	6–15	Yes
Light export	10–16	6–10	No
Domestic manufacturing	17–21	0–15	Yes

a)   Determine the expected final weight and carcass weight of the two groups of sheep.
     Give your answers to two decimal places.   *[4 marks]*

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b)   Determine the target market for the two groups of sheep.   *[2 marks]*

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QUESTION 9 (5 marks)

The table gives the results from a trial conducted on sugarcane over five years. A fallow crop of soybeans was planted, grown and ploughed back into the soil prior to planting the sugarcane.

A control practice was to leave the soil fallowed between sugarcane harvest and the next season's planting. At each location the mean crop yield was measured over five years.

Location	Legume fallow		Bare fallow	
	Nitrogen fertiliser applied (kg/ha)	Mean yield (t/ha)	Nitrogen fertiliser applied (kg/ha)	Mean yield (t/ha)
Site 1	54 ± 20	92 ± 1	85 ± 22	92 ± 1
Site 2	89 ± 24	147 ± 3	152 ± 9	149 ± 4
Site 3	92 ± 28	169 ± 4	155 ± 13	172 ± 5
Site 4	65 ± 25	121 ± 3	108 ± 11	122 ± 4
Site 5	60 ± 23	112 ± 2	109 ± 8	112 ± 2
Site 6	32 ± 11	107 ± 3	45 ± 5	115 ± 5

a)   Draw a conclusion about the most suitable crop rotation system to use. Use the table to justify your conclusion.

[2 marks]

b) Identify two advantages of the crop rotation system identified in 9a).   *[2 marks]*

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c) Provide one disadvantage of the crop rotation system identified in 9a).   *[1 mark]*

_____

_____

_____

Section 2

Instructions

- This section has one question and is worth 15 marks.
- Respond in 300–350 words.

QUESTION 10 (15 marks)

Refer to Stimulus 1–3 in the stimulus book.

Use three criteria to assess opportunities for sustainable social practices for an industry of your choice. For each criterion, analyse and justify three strengths and/or weaknesses.

Draw a conclusion about the sustainability of the production system.

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END OF PAPER

ADDITIONAL PAGE FOR STUDENT RESPONSES

Write the question number you are responding to.

Do not write outside this box.

ADDITIONAL PAGE FOR STUDENT RESPONSES

Write the question number you are responding to.

Do not write outside this box.

References

Question 1

Angus Australia 2016, *Capitalising on the Genetic Variation between Angus Animals*, www.angusaustralia.com.au/content/uploads/2016/11/Ash_POC_Genetic_Variation_A4_8page.pdf.

Question 3

Adapted from Stats NZ 2014, 'Fresh fruit and vegetable prices — our global connection', Price Index News, January, http://archive.stats.govt.nz/tools_and_services/newsletters/price-index-news/jan-14-fruit-and-vege.aspx. Used under Creative Commons Attribution 4.0 licence (CC BY 4.0).

Question 4

Nuseed 2019, 'Nuseed Quartz: The new standard for mid-season maturity', www3.nuseed.com/au/product/nuseed-quartz.

Question 7

Adapted from 5-IBA-Brianna's High School n.d., 'Graphing practice', https://bibanez.weebly.com/graphing-practice.html.

Question 8

Australian Wool Innovation and Meat and Livestock Australia 2008, 'Module 3: Market focused lamb and sheepmeat production', *Making More From Sheep*, www.makingmorefromsheep.com.au/market-focussed-lamb-and-sheepmeat-production/tool_3.2.htm.

Question 9

Parka, SE, Websterb, TJ, Horanc, HL, Jamesd, AT & Thorbunc, PJ 2010, 'A legume rotation crop lessens the need for nitrogen fertiliser throughout the sugarcane cropping cycle', *Field Crops Research*, vol. 119, no. 2–3, pp. 331–41.