Agricultural Science marking guide and response

External assessment 2024

Combination response (101 marks)

Assessment objectives

This assessment instrument is used to determine student achievement in the following objectives:

1. describe and explain animal and plant production, agricultural enterprises, enterprise management, and evaluation of an agricultural enterprise
2. apply understanding of animal and plant production, agricultural enterprises, enterprise management, and evaluation of an agricultural enterprise
3. analyse evidence about animal and plant production, agricultural enterprises, enterprise management, and evaluation of an agricultural enterprise to identify trends, patterns, relationships, limitations or uncertainty
4. interpret evidence about animal and plant production, agricultural enterprises, enterprise management, and evaluation of an agricultural enterprise to draw conclusions based on analysis.

Note: Objectives 5, 6 and 7 are not assessed in this instrument.

Purpose

This document consists of a marking guide and a sample response.

The marking guide:

- provides a tool for calibrating external assessment markers to ensure reliability of results
- indicates the correlation, for each question, between mark allocation and qualities at each level of the mark range
- informs schools and students about how marks are matched to qualities in student responses.

The sample response:

- demonstrates the qualities of a high-level response
- has been annotated using the marking guide.

Mark allocation

Where a response does not meet any of the descriptors for a question or a criterion, a mark of '0' will be recorded.

Where no response to a question has been made, a mark of 'N' will be recorded.

Allow FT mark/s — refers to 'follow through', where an error in the prior section of working is used later in the response, a mark (or marks) for the rest of the response can still be awarded so long as it still demonstrates the correct conceptual understanding or skill in the rest of the response.

Marking guide

Multiple choice

Question	Response
1	D
2	A
3	A
4	D
5	C
6	C
7	D
8	C
9	C
10	B
11	B
12	D
13	A
14	A
15	B

Paper 1: Short response

Q	Sample response	The response:
16	Lettuce is produced in the Lockyer Valley, harvested and then transported to a processing plant. At the processing plant, lettuce is washed and chopped, then placed into food safe plastic bags. This allows the lettuce to be sold at a higher price per kilogram (i.e. value adding). The marketing of this product can involve direct sale to retail outlets. For example, bags of lettuce from a processing plant can be transported directly to takeaway chains.	• identifies a plant product **[1 mark]** • describes the post-harvest process of transport to a packhouse/storage facility **[1 mark]** • explains the post-harvest process of handling, packaging or grading **[1 mark]** • describes one marketing strategy **[1 mark]** • describes how value is added to the product **[1 mark]**
17	Market specifications are the quality standards required by the buyers of the product. Two examples are carcass weight and fat depth.	• describes market specifications **[1 mark]** • provides one example of a specification **[1 mark]** • provides a second example of a specification **[1 mark]**
18a)	*Helicoverpa* in cotton	• identifies a regionally significant plant pest **[1 mark]** • identifies the crop that is affected by the pest **[1 mark]**
18b)	Genetically modified cotton is commonly used as a biological control method for *Helicoverpa* in cotton. Certain varieties of cotton have been genetically modified to produce a natural toxin that targets the caterpillar larvae, reducing the instances of *Helicoverpa* in these genetically modified cotton crops.	• identifies a control measure relevant to the pest identified in Question 18a) **[1 mark]** • explains how the control measure affects the pest **[1 mark]**

Q	Sample response	The response:
19	Conclusion 1: Due to consumer demand, the number of wool producers that mules their sheep is declining. The number of producers that do not mules their sheep increased from 5.0% in 2011 to 12.6% in 2021. Wool from sheep mulesed without pain relief is more likely to be left unsold (26.3% in 2022) compared to wool from non-mulesed sheep (18% in 2022). Conclusion 2: Where mulesing is still occurring, producers are more likely to use pain relief. In 2011, 17% of producers mulesed their sheep with pain relief, whereas in 2021, 47.5% mulesed their sheep with pain relief. The wool from sheep mulesed with pain relief (22.8% unsold in 2022) was more likely to be sold than wool from sheep mulesed without pain relief (26.3% unsold in 2022).	• draws a conclusion **[1 mark]** • justifies the conclusion using evidence from the – practices table **[1 mark]** – sales table **[1 mark]** • draws a second conclusion **[1 mark]** • justifies the second conclusion using evidence from the – practices data **[1 mark]** – sales data **[1 mark]**
20a)	Number of nodules per plant: The combination fertiliser produced more nodules per plant than either fertiliser A or B alone. Grain yield: The actual grain yield was very similar for fertiliser B and the combination fertiliser, both of which outperformed fertiliser A.	• contrasts an effect for number of nodules/plants **[1 mark]** • contrasts an effect for grain yield **[1 mark]**
20b)	Fertiliser B increases yield most efficiently, as the smaller number of nodules produced on the plant produces a similar grain yield to the effect of the combined fertiliser A and B which had a greater number of nodules per plant.	• draws a conclusion **[1 mark]** • justifies the conclusion **[1 mark]**
21	A dairy farmer can diversify their income by growing a dryland grain crop that can be used to supplement available feed for cattle or sold if feed prices are high or milk prices are low.	• identifies an appropriate risk avoidance strategy **[1 mark]** • identifies an appropriate agricultural example **[1 mark]** • explains how the strategy will reduce potential production losses **[1 mark]**

Q	Sample response	The response:
22a)	Total percentage loss of lettuce during post-harvest processes = processing and packaging loss + transport loss = 8% + 12% = 20%	• determines total percentage loss of product during post-harvest processes **[1 mark]**
22b)	Closed plastic refrigerated is the most appropriate form of storage.	• draws a conclusion **[1 mark]**
22c)	Closed plastic refrigerated is the most appropriate form of storage because the refrigeration of lettuce minimises the loss of product during the post-harvest phase.	• explains how closed plastic refrigeration minimises loss of product **[1 mark]**
23a)	Variety 1 and 3. The average mean yield values for variety 1 and 3 are higher than the other variety mean values in a hoophouse environment, and the respective error bars do not overlap, suggesting there is a significant difference.	• determines varieties 1 and 3 **[1 mark]** • justifies decision using yield values **[1 mark]** • justifies decision using error bars **[1 mark]**
23b)	Variety 2 and 5. These varieties have the smallest average marketable yield,	• determines varieties 2 and 5 **[1 mark]** • justifies decision **[1 mark]**

Paper 2: Short response

Q	Sample response	The response:
1	Lactating cows have a higher energy requirement in contrast to non-lactating cows due to the increased energy demand for milk production. Therefore, the amount of net energy available to lactating cows must be great enough to firstly meet the energy demand for maintenance functions and then the energy demand for milk production. Additional grain for lactating cows will help to meet the energy demands for milk production. Non-lactating cows have a smaller energy requirement, and this can be satisfied by pasture.	• explains the difference in energy requirements between lactating and non-lactating cows **[1 mark]** • identifies that maintenance functions of an animal must be supplied **[1 mark]** • explains how cereal grain can supply the required additional energy to meet milk production requirements **[1 mark]** • identifies that pasture will be sufficient to meet the lower energy needs of non-lactating cows **[1 mark]**
2	Disease 1: Clostridial diseases — cattle need to be vaccinated and there is a cost incurred in purchasing the chemical. Disease 2: Buffalo fly — farmers need to ear tag cattle, which incurs costs for wages (time spent ear-tagging) and purchasing of ear tags.	• identifies an Australian agricultural animal disease **[1 mark]** • describes a financial effect on farmers for this disease **[1 mark]** • identifies a second Australian agricultural animal disease **[1 mark]** • describes a financial effect on farmers for this disease **[1 mark]**
3a)	Similarity: In 1999–2000, Australian agricultural exports to Asian countries and the rest of the world were similar, with 52% exported to Asia and 48% exported to the rest of the world. Difference: Since then, the difference between the two has increased. In 2019–2020, Asian exports increased by 24%, whereas exports to the rest of the world decreased to only 24%. Significance: This difference identifies the increasing importance of Asian export markets for Australia.	• identifies a similarity between Australian agricultural exports to Asian countries and the rest of the world in 1999–2000 **[1 mark]** • identifies a difference between Australian agricultural exports to Asia and the rest of the world from 1999–2000 and 2019–2020 data **[1 mark]** • identifies the significance of this change regarding exports to Asian countries **[1 mark]**

Q	Sample response	The response:
3b)	Australian free trade agreements have resulted in a greater economic relationship with ASEAN countries and China compared to a significant reduction of exports to the rest of the world. Increasing free trade agreements with ASEAN and China (net 27% gain) is very important for economic security within the Australian agricultural economy. There is a risk in decreasing exports with Japan and other rest of the world countries if China or any of the ASEAN countries impose higher tariffs or reduce quotas for Australian agricultural exports. This would result in less opportunity for agricultural industries to remain financially stable.	• draws a conclusion about the importance of Australia's free trade agreements with ASEAN countries and China in terms of export growth **[1 mark]** • identifies a piece of evidence from the graphs to support the conclusion **[1 mark]** • identifies a second piece of evidence from the graphs to support the conclusion **[1 mark]**
4a)	1. Loose skin 2. Large pendulous ears	• identifies a physical characteristic **[1 mark]** • identifies a second physical characteristic **[1 mark]**
4b)	Large pendulous ears allow greater evaporative cooling.	• describes how one characteristic from Question 4a) makes the animal suited to tropical production areas of Australia **[1 mark]**
5	Bull A This is due to the higher 200-day milk production value at +10 kg. Bull C has a similar 200-day milk ABV, but Bull A has a higher 200-day weight for calves.	• identifies bull A **[1 mark]** • identifies a piece of evidence from the table to support the decision **[1 mark]** • identifies a second piece of evidence from the table to support the decision **[1 mark]**
6a)	Growth rate for gibberellic acid-treated dwarf peas = 9/11 = 0.82 cm/day	• shows working **[1 mark]** • calculates growth rate **[1 mark]**

Q	Sample response	The response:
6b)	Similarity: The growth rates of the treated and non-treated peas were similar on day 1 and from day 10 to day 20 of the trial. Difference: The growth rate of the treated dwarf peas was much greater from day 2 to day 9 in contrast to the growth rate of the non-treated peas. Significance: The gibberellic acid treatment increases early growth rate, which would allow better establishment of a dwarf pea crop.	• identifies a period of similar growth rate **[1 mark]** • identifies the growth rates were different on days 2–9 **[1 mark]** • describes the significance of the difference between the treatments **[1 mark]**
7a)	Feed A Feed A has the lowest level of protein and digestible energy. Pigs at this stage of their production cycle have finished growing and therefore require less protein and energy.	• determines feed A **[1 mark]** • justifies decision **[1 mark]**
7b)	Total weight gain of one pig in group A = 3 kg x 25 days = 75 kg Total weight gain of group A = 75 kg per pig x 10 pigs = 750 kg Feed conversion ratio of group A = 830/750 = 1.1	• calculates the total weight gain of one pig in group A **[1 mark]** • calculates the total weight gain for the pigs in group A **[1 mark]** • calculates the feed conversion ratio **[1 mark]**
7c)	Group A is the most efficient group of pigs because it has a lower feed conversion ratio (1.1), which means that animals in this group are more efficient at converting feed into meat.	• identifies the most efficient group of pigs **[1 mark]** • justifies the conclusion **[1 mark]**

Q	Sample response	The response:
8	The two systems receive the same income per tonne of canola ($460/t); however, the irrigated system produces 0.5 t more per ha than the dryland system. The significance of this is that the total income is higher for the irrigated system. The most profitable system is the irrigated system. However, the variable expenses are higher for the irrigated system in contrast to the dryland system, so in terms of environmental sustainability, the dryland system is more environmentally sustainable with less inputs required, and its gross margin is similar to the irrigated system. Therefore, the dryland system is the more financially and environmentally sustainable enterprise.	• identifies a difference in yield **[1 mark]** • identifies higher variable costs for the irrigated system **[1 mark]** • identifies that less inputs are required for the dryland system **[1 mark]** • draws a justified conclusion [**1 mark]**

Extended response — Question 9

Sample response	The response:
Physical resource management • Soil management practices through use of effluent increases nutrient and organic matter content, increasing fertility of soil and reducing the requirement for fertilisers. (strength) • The land and water are being managed sustainably using drainage systems to catch runoff and direct it away from the pens and feed area and into the effluent ponds. (strength) • An improvement of the physical resources could include increasing the capacity of the emergency overflow spillways of the effluent ponds to prevent these overflowing and contaminating the nearby natural environment with animal waste. (weakness)	• for physical resource management – identifies a sustainable practice **[1 mark]** – justifies the practice **[1 mark]** – identifies a second sustainable practice **[1 mark]** – justifies the second practice **[1 mark]** – explains how a practice could be improved **[1 mark]**
Biological resource management • The natural resources are being managed sustainably through the selection of appropriate breeds of cattle that have a low feed conversion ratio, making them efficient in converting grain to weight gain. (strength) • Plant matter is being managed sustainably through the enterprise's selection and production of its own roughage and grain to feed to the cattle rather than relying solely on purchasing these from other suppliers. (strength) • An improvement in biological resource management could include the use of integrated pest management to control flies rather than relying on chemicals alone, which can cause resistance and reduce biodiversity in the environment by affecting non-target insects. (weakness)	• for biological resource management – identifies a sustainable practice **[1 mark]** – justifies the practice **[1 mark]** – identifies a second sustainable practice **[1 mark]** – justifies the second practice **[1 mark]** – explains how a practice could be improved **[1 mark]**

Sample response	The response:
Waste management • Waste is sustainably managed using sloping to drain effluent material away, reducing odour. (strength) • Recycling the effluent onto the cropping paddocks is a sustainable use of waste, as this reduces the chance of the waste contaminating the nearby natural environment. (strength) • Using effluent on the cropping paddocks may increase disease susceptibility. An improvement could be to monitor effluent pond quality, monitor soil quality, monitor health of animals in feedlot. (weakness)	• for waste management: – identifies a sustainable practice **[1 mark]** – justifies the practice **[1 mark]** – identifies a second sustainable practice **[1 mark]** – justifies the second practice **[1 mark]** – explains how a practice could be improved **[1 mark]**
This enterprise would be considered environmentally sustainable across all three criteria, although there are areas that could be improved.	• draws a conclusion about the environmental sustainability of the enterprise **[1 mark]** • justifies the conclusion **[1 mark]**

Extended response — Question 10

Sample response	The response:
Physical resource management • The use of legumes every five years helps to ensure that additional nitrogen (from addition of fertilisers) is controlled and converted to available forms of nitrogen in the soil profile. Excessive addition of synthetic fertiliser could lead to a decrease in the soil pH and an increase in soil acidity, which could affect cane yield. (strength) • While irrigation could be accessed by pumping from the river, the property only makes use of the high annual rainfall. This ensures that there is minimal disturbance of creek flow and, ultimately, river flow. (strength) • Consideration should be given to green stick harvesting instead of burning crops prior to harvest. Reducing the vegetation on the soil surface increases the risk of soil erosion. Soil erosion could lead to an increase in turbidity and excess nutrient runoff into the river (possible eutrophication). (weakness)	• for physical resource management: – identifies a sustainable practice **[1 mark]** – justifies the practice **[1 mark]** – identifies a second sustainable practice **[1 mark]** – justifies the second practice **[1 mark]** – explains how a practice could be improved **[1 mark]**

Sample response	The response:
Biological resource management • The use of a pesticide on a regular basis to manage the cane beetle ensures that the maximum yield of cane is maintained each season. A high population of beetles could lead to a potential reduction in yield across future seasons. (strength) • The non-pumping of the creek running through the property allows the natural inhabitants to have consistent access to water (and other resources), ensuring a balanced ecosystem both in the creek and the river it drains into. (strength) • The use of a monocropping system places the crop at risk from disease or pest outbreak. The monocrop has no natural biological genetic variation that may reduce the outbreak (natural resistance). Thus, a single disease could destroy an entire season. An improvement could be to implement a polyculture system to protect against this risk. (weakness)	• for biological resource management: – identifies a sustainable practice **[1 mark]** – justifies the practice **[1 mark]** identifies a second sustainable practice **[1 mark]** – justifies the second practice **[1 mark]** – explains how a practice could be improved **[1 mark]**
Waste management • The direct drilling of fertiliser reduces the loss of product to the atmosphere, ensuring maximum use of an input to increase yield. This also reduces the possibility of runoff removing the product from the soil. (strength) • The producer uses the latest technologies in chemical application of herbicides, ensuring that overspray and loss of product (waste) is best managed. (strength) • The burning of the cane removes the waste prior to harvesting; however, this also removes the material used by soil nutrient recyclers use to keep soil microbe levels active in between crop cycles. This balance of soil microbes could be beneficial in nutrient cycling, increase yield and reduce fertiliser requirements. An improvement could be to implement green stick harvesting practices. (weakness)	• for waste management: – identifies a sustainable practice **[1 mark]** – justifies the practice **[1 mark]** – identifies a second sustainable practice **[1 mark]** – justifies the second practice **[1 mark]** – explains how a practice could be improved **[1 mark]**
This enterprise would be considered environmentally sustainable across all three criteria, although there are areas that could be improved.	• draws a conclusion about the environmental sustainability of the enterprise **[1 mark]** • justifies the conclusion **[1 mark]**