

Agricultural Science

marking guide and response

External assessment 2023

Combination response (104 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	C
2	D
3	B
4	A
5	D
6	A
7	A
8	B
9	D
10	A
11	C
12	C
13	A
14	C
15	A
16	C
17	B
18	D
19	D
20	B

Paper 1: Short response

Q	Sample response	The response:
21	Bananas are initially transported from the field to a packhouse, where the bananas are sorted, graded and packaged ready for further transport. They are then transported to a storage facility where they are ripened. This may include the use of ethylene gas to control the ripening process. From this point, they are transported to markets and then to retail outlets.	<ul style="list-style-type: none"> • identifies an example of a horticultural 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] • explains the post-harvest process of controlling the ripening process [1 mark]
22a)	7.7	<ul style="list-style-type: none"> • provides 7.7 [1 mark]
22b)	The feed conversion ratio increases for an agricultural animal as it gets older.	<ul style="list-style-type: none"> • identifies the trend that the FCR increases as the animal gets older [1 mark]

Q	Sample response	The response:
23a)	<p>One management strategy is to restrict physical movement of hives outside the infested area.</p> <p>A second management strategy is to routinely monitor hives and report any unexpected hive deaths, production abnormalities and/or deformities to relevant biosecurity officers.</p>	<ul style="list-style-type: none"> • identifies a strategy [1 mark] • identifies a second strategy [1 mark]
23b)	<p>An example of a regional pest is Barber's pole worm in sheep.</p> <p>While the worms in the stomach are feeding on the sheep's blood, the animal will lose condition, which will negatively affect its production.</p>	<ul style="list-style-type: none"> • identifies the pest and associated animal [1 mark] • explains how this pest affects the associated animal [1 mark]
23c)	<p>Stage 1: Barber's pole worm is excreted from sheep in egg form.</p> <p>Stage 2: These eggs hatch as larvae in the grass.</p>	<ul style="list-style-type: none"> • describes a stage of the pest's life cycle [1 mark] • describes a second stage of the pest's life cycle [1 mark]
23d)	<p>The Barber's pole worm is most vulnerable when its eggs are in the paddock. This is when the eggs can be removed by paddock rotation with a less desirable host animal, which is commonly used to break the worm's life cycle.</p>	<ul style="list-style-type: none"> • identifies when the pest is most vulnerable [1 mark] • explains why the pest is vulnerable [1 mark]

Q	Sample response	The response:
24	<p>Sowing rate is often less for dryland cropping than irrigated cropping, as water is a limitation in dryland cropping and lower sowing rates have lower plant density, resulting in lower competition for water.</p> <p>Plant spacing will normally be greater in dryland cropping compared to irrigated, so that plant density is less under conditions where water is limited.</p> <p>For example, the sowing rate for dryland cotton is less and plant spacing greater, when compared to irrigated cotton.</p>	<ul style="list-style-type: none"> explains a difference in sowing rate between dryland and irrigated conditions [1 mark] explains a difference in plant spacing between dryland and irrigated conditions [1 mark] identifies a relevant broadacre crop [1 mark]
25	<p>An increase in the retail value over time indicates an increase in the level of organic production. When looking at the criteria of income and employment, the increase over time in production of organic products would indicate that organic farming enterprises are socially sustainable in these areas.</p> <p>The retail value data shows the value for organic farming from 1992 to 2012. The estimated value from organic products and subsequent farm income is increasing rapidly. This would indicate that an organic farming enterprise is likely to be financially sustainable.</p> <p>The energy profile data shows a comparison between organic and conventional cropping's energy use in several areas. Organic farming has higher labour use than conventional farming, indicating that the number of workers involved in organic farming as it grows as an industry would be increasing. This increase in employment would benefit the local community.</p>	<ul style="list-style-type: none"> concludes that organic farming enterprises are socially sustainable under the income criteria [1 mark] concludes that organic farming enterprises are socially sustainable under the employment criteria [1 mark] uses the graph to justify the income conclusion [1 mark] uses the energy profiles to justify the employment conclusion [1 mark]
26	<p>Feeding chickens additive A will result in the most efficient feed conversion.</p> <p>The chickens in the control group required 1.6 units of feed to put on 1 unit of body weight, while the chickens fed additive A required 1.45 units of feed to gain the same amount of weight.</p> <p>Although the mean value is not statistically different to the mean for additive B, the graph indicates that the animals don't need as much feed.</p>	<ul style="list-style-type: none"> draws an appropriate conclusion [1 mark] uses one piece of evidence to support the conclusion [1 mark] uses a second piece of evidence to support the conclusion [1 mark]

Q	Sample response	The response:
27a)	Two biological control methods are preserving predators, e.g. ladybirds, and introducing enemies, e.g. parasitic wasps.	<ul style="list-style-type: none"> • identifies preserving predators and introducing enemies [1 mark]
27b)	Biological organisms can be used as a biological control method to reduce the use of chemicals, which can be harmful to other useful organisms. This also reduces the expense of using costly insecticides.	<ul style="list-style-type: none"> • explains an advantage of biological controls [1 mark] • explains a second advantage of biological controls [1 mark]

Paper 2: Short response

Q	Sample response	The response:
1	<p>The lamb producer should consider diversifying into other enterprises. For example, they could grow dryland wheat.</p> <p>This will result in a secondary income stream for the producer. If the dryland crop fails, it can still be used as a source of feed for lambs.</p>	<ul style="list-style-type: none"> describes a strategy [1 mark] explains how this will minimise the effect of drought on farm income [1 mark]
2	<p>Animal A Price/kg = 645 c/kg – 5 c/kg for sex = 640 c/kg. Total value = 270 kg × 640 c/kg = \$1728</p> <p>Animal B Price/kg = 655 c/kg + 25 c/kg for MSA = 680 c/kg Total value = 310 kg × 680 c/kg = \$2108 Animal B is worth more on the domestic market.</p>	<ul style="list-style-type: none"> determines <ul style="list-style-type: none"> price/kg for A [1 mark] total value of A [1 mark] price/kg for B [1 mark] total value of B [1 mark] concludes that B is worth more than A [1 mark]
3	<p>Cotton has been genetically modified to tolerate certain brands of herbicide.</p> <p>A positive consequence of this is that these herbicides can be applied to the plant to reduce competition from weeds, without killing the cotton crop.</p> <p>A negative consequence is the consumer concern about genetically engineered crops, which can affect demand for the product.</p>	<ul style="list-style-type: none"> identifies a relevant plant [1 mark] explains a positive consequence [1 mark] explains a negative consequence [1 mark]
4	<p>Variety C is recommended for high rainfall areas. Variety C is resistant to stem rust in contrast to variety A.</p> <p>Variety C is resistant to crown rot in contrast to both varieties A and B.</p> <p>Variety C is tolerant of acidic soils in contrast to variety B.</p>	<ul style="list-style-type: none"> draws an appropriate conclusion [1 mark] uses rust evidence [1 mark] uses crown rot evidence [1 mark] uses acidic soils evidence [1 mark]

Q	Sample response	The response:
5	<p>Ruminants do not require essential amino acids as part of their diet while monogastrics do.</p> <p>Ruminants can synthesise their own protein while monogastrics can't.</p> <p>Ruminants use microbial digestion while monogastrics use enzymatic digestion of protein.</p> <p>Ruminants metabolise protein to ammonia, which is used to form microbial protein, while monogastrics metabolise to amino acids only.</p>	<ul style="list-style-type: none"> • identifies a <ul style="list-style-type: none"> – difference [1 mark] – second difference [1 mark] – third difference [1 mark] – fourth difference [1 mark]
6a)	Grafting	<ul style="list-style-type: none"> • identifies an asexual propagation method [1 mark]
6b)	<p>Grafting is a technique where the tissue of one plant is joined with another so that they continue to grow together.</p> <p>Grafting is commonly done with citrus trees.</p>	<ul style="list-style-type: none"> • describes the method [1 mark] • identifies a relevant agricultural example [1 mark]
7	<p>The ownership structure is a company.</p> <p>Characteristics of a company include that:</p> <ul style="list-style-type: none"> • it is a legal entity formed by a group of individuals to manage and operate a business enterprise, e.g. 'The owners of this business' • profits of companies may be distributed or withheld and are taxable, e.g. business is listed on the Australian Securities Exchange. 	<ul style="list-style-type: none"> • identifies the ownership structure [1 mark] • identifies a characteristic of the identified ownership structure [1 mark] • identifies evidence of the first characteristic [1 mark] • identifies a second characteristic of the identified ownership structure [1 mark] • identifies evidence of the second characteristic [1 mark]

Q	Sample response	The response:
8	Initially demand would stay the same, but due to a decrease in apricot supply, the supply line would move (slide) to the right, resulting in an increase in the equilibrium market price (\$/case). In the long-term, demand would decrease because of the increase in price.	<ul style="list-style-type: none"> identifies the effect on <ul style="list-style-type: none"> supply [1 mark] equilibrium market price [1 mark] long-term demand [1 mark]
9a)	240 kg N/ha/year	<ul style="list-style-type: none"> provides 240 [1 mark]
9b)	When nitrogen is added to the soil, there is an initial increase in NUE, but from 48 kg N/ha/year, NUE starts to decline.	<ul style="list-style-type: none"> identifies initial increase in NUE [1 mark] identifies decline in NUE [1 mark]
9c)	The optimal level of nitrogen application is between 96 and 144 kg N/ha/year. At this level, NUE is equal to or greater than the level when no nitrogen is applied. Secondly, the response in yield to addition of N fertiliser is starting to level off.	<ul style="list-style-type: none"> draws an appropriate conclusion [1 mark] identifies one supporting piece of evidence [1 mark] identifies a second supporting piece of evidence [1 mark]
10a)	BSE could impact a cattle production system by decreasing domestic consumption due to consumer concern. It could also decrease international demand (exports) due to consumer concern.	<ul style="list-style-type: none"> identifies an impact [1 mark] identifies a second impact [1 mark]
10b)	Risk management strategies to reduce the risk/effect of the disease include strict border control (seizing animal products) and imposing restrictions on ruminant animals being fed animal products.	<ul style="list-style-type: none"> identifies a strategy [1 mark] identifies a second strategy [1 mark]

Extended response — Question 11

Sample response	The response:
<p>The three environmental management criteria to consider are physical resources, biological resources and waste management.</p> <p>Considering beef and cropping production:</p> <p>Physical resource management</p> <ul style="list-style-type: none"> • Livestock can access the river, which may increase erosion, affecting soil structure (weakness). • Crop rotations can improve soil structure (strength). • Irrigation timing is done on a visual basis of plant health. This may not be accurate and may affect the quantity of water being used (weakness). <p>Biological resource management</p> <ul style="list-style-type: none"> • Cattle have characteristics from both breeds. The <i>Bos Indicus</i> has parasite resistance, which would decrease the amount of chemicals required (strength). • Crop rotation helps break pest and disease cycles (strength). • Crop rotation can improve amount and type of beneficial organisms due to crop diversity (strength). <p>Waste management</p> <ul style="list-style-type: none"> • Cattle have characteristics from both breeds. The <i>Bos Taurus</i> is early maturing and helps to reach market specs sooner, which would allow a reduction in carbon emissions (strength). • Improved pastures means that cattle maximise growth and will reduce time spent to reach market specs (strength). • Crop rotation with legumes included means possible reduction of nitrogen fertiliser and therefore less risk of ecosystem contamination (strength). 	<p>Identification of criteria</p> <ul style="list-style-type: none"> • identifies physical resource management as a criterion [1 mark] • identifies biological resource management as a criterion [1 mark] • identifies waste management as a criterion [1 mark] <p>Analysis of physical resource management</p> <ul style="list-style-type: none"> • analyses a strength or weakness [1 mark] • analyses a second strength or weakness [1 mark] • analyses a third strength or weakness [1 mark] <p>Analysis of biological resource management</p> <ul style="list-style-type: none"> • analyses a strength or weakness [1 mark] • analyses a second strength or weakness [1 mark] • analyses a third strength or weakness [1 mark] <p>Analysis of waste management</p> <ul style="list-style-type: none"> • analyses a strength or weakness [1 mark] • analyses a second strength or weakness [1 mark] • analyses a third strength or weakness [1 mark]

Sample response	The response:
<p>This enterprise would be considered environmentally sustainable across all three criteria, although there are areas that could be improved.</p> <p>The reduced use of chemicals through crop rotations, GM cotton and breeds of animals allows a reduction in potential chemical runoff and decreases the risk to beneficial organisms.</p> <p>Crop and paddock rotation allow for increased carbon sequestration and improved soil structure, while increasing the soil biodiversity and nutrient availability.</p> <p>There is the potential for faecal and sediment contamination of waterways through livestock access to the river and manure stockpiles being situated uphill from the river.</p> <p>Examples of management practices to improve sustainability:</p> <ul style="list-style-type: none"> • Neutron probes could be used to determine when irrigation is required. This will improve water use efficiency. • Bankless channels could be incorporated into irrigation design to improve water use efficiency. 	<p>Conclusion</p> <ul style="list-style-type: none"> • provides a justified conclusion for physical resource management [1 mark] • provides a justified conclusion for biological resource management [1 mark] • provides a justified conclusion for waste management [1 mark] • provides a justified conclusion about environmental sustainability [1 mark] • explains a management practice [1 mark] • explains a second management practice [1 mark]



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