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Government of **Western Australia**
School Curriculum and Standards Authority

ANIMAL PRODUCTION SYSTEMS

ATAR course examination 2024

Marking key

Marking keys are an explicit statement about what the examining panel expect of candidates when they respond to particular examination items. They help ensure a consistent interpretation of the criteria that guide the awarding of marks.

Section One: Multiple-choice **20% (20 Marks)**

Question	Answer
1	b
2	a
3	c
4	a
5	b
6	d
7	d
8	c
9	b
10	c
11	d
12	b
13	b
14	a
15	c
16	a
17	b
18	c
19	d
20	c

Section Two: Short answer **50% (103 Marks)**

Question 21 **(17 marks)**

(a) Compare the concepts of economic threshold (ET) and economic injury level (EIL) in pest management. (5 marks)

Description	Marks
Compares ET and EIL in pest management	5
Explains ET and EIL in pest management	4
Describes ET and EIL in pest management	3
States a fact about ET and EIL in pest management	2
States a fact about ET or EIL in pest management	1
Total	**5**
Answers could include: For copyright reasons this text cannot be reproduced in the online version of this document. • • ET is the pest density at which control measures should be initiated to prevent the pest population from reaching the EIL. It acts as a buffer zone, allowing for proactive intervention before significant economic damage occurs • EIL is a fixed value specific to the pest-crop combination and takes into account factors such as crop value, pest damage potential and control costs. ET can vary depending on factors such as pest population growth rate, time to control effectiveness and the proximity to the EIL.	
Accept other relevant answers.	

(b) (i) Identify **two** different pest control methods you could choose to compare. (2 marks)

Description	Marks
For each method (2 x 1 marks)	
Identifies a pest control method relevant to parasites in livestock	1
Total	**2**
Answers could include: • oral drench • injection • pest traps • chemical • biological.	
Accept other relevant answers.	
Note: candidates can receive full marks if they choose two methods of, e.g. chemical control, but only one mark if they choose two that are different brands of the same method.	

Question 21 (continued)

(ii) State a hypothesis you could test for your investigation. (2 marks)

Description	Marks
Makes a statement that predicts a relationship between the dependent and independent variable	2
Makes a statement that includes two variables	1
Total	**2**
Answers could include: The application of oral drench will result in a significant reduction in the pest population of blowflies in sheep over the test period, compared to fly traps.	
Accept other relevant answers.	

(iii) Comment on each of the following aspects of experimental design when planning your investigation. (8 marks)

Description	Marks
For each element (4 x 2 marks)	
States a relevant way the factor could be considered in an investigation	2
Makes a statement about the element of experimental design	1
Total	**8**
Answers could include: • controlled variables are factors that could influence results, so are intentionally kept constant throughout the experiment. For example, use a single breed or ensure that the distribution of breeds is consistent across treatment groups • randomisation involves the random assignment of livestock to different treatment groups to minimise biases and ensure that treatment groups are comparable. For example, a random method can be used to assign livestock to different pest control methods • replication involves the repetition of the entire experiment to improve the reliability of results. It can be used by repeating the investigation in a different area • experimental error is the variability in the results that cannot be attributed to the pest control method (independent variable). For example, if different people are taking measurements, it could increase experimental error as they could use different methods. Also, some measurements may be subjective, so this needs to be included in the methodology to ensure the measurements are the same.	
Accept other relevant answers.	

Question 22 **(15 marks)**

(a) Using an example, explain the relationship between modes of action of pesticides and their effectiveness in treating animals. (5 marks)

Description	Marks
Explains the relationship between modes of action of pesticides and their effectiveness in treating animals	4
Describes the relationship between modes of action of pesticides and their effectiveness in treating animals	3
Outlines the relationship between modes of action of pesticides and their effectiveness in treating animals	2
Identifies a relationship between modes of action of pesticides and their effectiveness in treating animals	1
Subtotal	**4**
Provides a relevant example	1
Subtotal	**1**
Total	**5**

Answers could include:

Relationship

- the mode of action allows specific pesticide treatments according to the needs of the particular livestock enterprise, making them more efficient and/or profitable. Employing a variety of modes of action within a program reduces the risk of resistance and helps to effectively manage strains of parasites that have developed resistance
- using multiple modes of action allows for a more selective treatment approach, which can lead to improved efficiency by:
  - limiting the development of resistance
  - minimising the frequency of required treatments
  - reducing overall costs.

Example for improving effectiveness in treating lice in chickens

- Insect Growth Regulators (IGRs) disrupt the growth and development of insects by interfering with their moulting process. IGRs can be applied topically to the chickens or in their environment. They prevent the development of immature stages of pests, such as mites, reducing the population over time

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Accept other relevant answers.

Question 22 (continued)

(b) Describe **two** ways in which pesticide resistance can be avoided or managed. Do not include changing mode of action in your answer. (6 marks)

Description	Marks
For each way (2 x 3 marks)	
Describes a way to avoid or manage pesticide resistance	3
Outlines a way to avoid or manage pesticide resistance	2
States a way to avoid or manage pesticide resistance	1
Total	**6**
Answers could include: • dose management ensures that pesticides are applied at the recommended and optimal dosage rates. Using inadequate doses may not effectively control the target pests, and using excessive doses may increase the selective pressure for resistance • establish an integrated pest management (IPM) program to leverage non-chemical alternatives, including practices like selective breeding for resistance, biological controls, grazing management and the implementation of cultural management techniques.	
Accept other relevant answers.	

(c) Outline **two** farm records that are required to meet quality assurance criteria in relation to livestock pest management. (4 marks)

Description	Marks
For each relevant farm record (2 x 2 marks)	
Outlines a relevant farm record that is required to meet quality assurance criteria in relation to livestock pest management	2
States a farm record that is required to meet quality assurance criteria in relation to livestock pest management	1
Total	**4**
Answers could include: For dose management, records required could include: • the name, formulation and active ingredient/s of the pesticide used • the date of pesticide application • specify the method of application (e.g. spraying, dipping or injection) and the dosage • specify the group, location or area where the pesticide was applied e.g. specific herd, shed, paddock or grazing area • document details of the livestock treated, such as species, age, weight and other relevant characteristics • record the withholding period for meat, milk or other animal products, ensuring compliance with regulatory requirements.	
Accept other relevant answers.	

Question 23 **(16 marks)**

(a) Define the term 'estimated breeding values' (EBV). (2 marks)

Description	Marks
Defines estimated breeding values	2
Makes a statement about estimated breeding values	1
Total	**2**
Answers could include: Estimated breeding value is an animal's relative genetic strength for traits, half of which will be passed on to its offspring.	
Accept other relevant answers.	

(b) State why an EBV is only an estimation for performance. (1 mark)

Description	Marks
Makes a statement about estimating EBV	1
Total	**1**
Answers could include: EBV is an estimation because actual animal performance and visual appearance results from both genes and environment, not just genes.	
Accept other relevant answers.	

(c) Describe why raw values are adjusted to create an EBV. (3 marks)

Description	Marks
Describes why raw values are adjusted to create an EBV	3
Outlines why raw values are adjusted to create an EBV	2
Makes a statement about adjusting raw values	1
Total	**3**
Answers could include: To determine how offspring would have performed if they were born at the same time as singletons raised in the same way.	
Accept other relevant answers.	

(d) (i) Calculate the expected average weight, in kg, of the calves of Bull 1 and Bull 2 at 600 days, assuming the maternal herd is equal to the breed average. (2 marks)

Description	Marks
Bull 1: 505 + (0.5 x 18) = 514 kg	1
Bull 2: 505 + (0.5 x 23) = 516.5 kg	1
Total	**2**

Question 23 (continued)

(ii) Explain which bull you would recommend using. (3 marks)

Description	Marks
Explains a relevant relationship between the breeding values and a related breeding objective/s	3
Outlines a relationship between the breeding values and breeding objective/s	2
Makes a statement about the relationship between the breeding values and breeding objective/s	1
Total	**3**
Answers could include: Bull 2 because, on average, its progeny will be heavier at 600 days. This means the herd's growth rates will increase over this time, meeting the breeding objective of increased growth. or Bull 1 as, on average, its progeny will be heavier at 400 days, despite being smaller at birth than Bull 2's. This meets the breeding objective of increased growth, assuming the animals are being sold as yearlings.	
Accept other relevant answers.	

(iii) Outline a reason why the bull you did not select in part (d)(ii) above may be more profitable. (2 marks)

Description	Marks
Outlines a relationship between the non-selected bull and profitability	2
Makes a statement about the non-selected bull	1
Total	**2**
Answers could include: Selecting for increased growth may lead to alterations in other economically significant traits that can indirectly impact profitability. Choosing Bull 2 with higher growth rates may lead to elevated birth weights, potentially resulting in an increase in calving difficulties.	
Accept other relevant answers.	
Note: 0 marks if the same bull is used in part (d)(ii) and part (d)(iii).	

(e) Describe the role of pedigrees in a breeding program. (3 marks)

Description	Marks
Describes the role of pedigrees in a breeding program	3
Outlines the role of pedigrees in a breeding program	2
Makes a statement about the role of pedigrees in a breeding program	1
Total	**3**
Answers could include: Pedigrees are used to track ancestry, assess genetic merit for selection, manage inbreeding risks, preserve genetic diversity and maintain accurate records of individual animals. This information is used to make informed decisions to meet the breeding goals of the enterprise.	
Accept other relevant answers.	

Question 24 **(20 marks)**

(a) Complete the following table. (6 marks)

Description	Marks
For each correct answer	1
Total	**6**

Answers could include:

Nutrient	Common source	Site of digestion in a ruminant	Site of digestion in a monogastric
Carbohydrates	Oats	*Rumen*	*Small intestine (or duodenum)*
Protein	*Lupins*	*Abomasum*	Stomach
Fat	*Milk*	Small intestine	*Small intestine (or duodenum)*

Accept other relevant answers for common source only, such as:

- protein – silage, hay, urea
- fat – oilseeds

(b) Contrast the metabolism of protein in a ruminant and a non-ruminant animal. (4 marks)

Description	Marks
Contrasts the ruminant and non-ruminant metabolism of protein	4
Outlines a main difference between the ruminant and non-ruminant metabolism of protein	3
Makes a relevant statement about ruminant and non-ruminant metabolism of protein	2
Makes a relevant statement about either ruminant or non-ruminant metabolism of protein	1
Total	**4**

Answers could include:

Ruminant and non-ruminant animals digest protein to provide amino acids. In ruminants, the protein is a source of nitrogen for rumen microbes, who breakdown fibre in the rumen and are then digested as microbial protein in the abomasum to release the amino acids. They are digested in different sites, in the stomach for monogastrics and in the abomasum for ruminants.

Accept other relevant answers.

Question 24 (continued)

(c) (i) Select **two** ingredients from the list below to make a 15% protein ration for a prime lamb feedlot. (2 marks)

Description	Marks
lupins	1
hay	1
Total	**2**

(ii) Calculate a prime lamb ration with the ingredients selected in part (c)(i) above. Using the Pearson square, show the percentage of each ingredient in the ration. Show your workings. (5 marks)

Description	Marks
lupins selected with correct % protein on left side of Pearson square	1
hay selected with correct % protein on left side of Pearson square	1
lupins 25 – 15 = 10	1
hay 10 – 15 = 5	1
lupins 33%, hay 67% (allow for rounding)	1
Total	**5**
Note: 0 marks for selecting a ration that cannot provide 15% protein. 0 marks for including meat meal in a prime lamb ration.	

(iii) Select **one** ingredient that should not be used in the ration in part (c)(ii) above and outline the reason. (3 marks)

Description	Marks
Ingredient	
Selects meat meal or wheat	1
Subtotal	**1**
Reason	
Outlines the reason for not using the stated ingredient	2
States a relevant fact about the ingredient that would preclude it from being used in a ration	1
Subtotal	**2**
Total	**3**
Answers could include: • meat meal is subject to the Australian Ruminant Feed Ban (or RAM – Restricted Animal Material), put in place to reduce the introduction and spread of bovine spongiform encephalopathy (BSE) in Australia • wheat is highly fermentable causing bloat and grain poisoning, but maybe used if introduced slowly.	
Accept other relevant answers.	

Question 25 **(18 marks)**

(a) Describe **two** reasons for the development of pesticide resistance. (6 marks)

Description	Marks
For each reason (2 x 3 marks)	
Describes a reason for the development of pesticide resistance	3
Outlines a reason for the development of pesticide resistance	2
Makes a relevant statement about the development of pesticide resistance	1
Total	**6**
Answers could include: • when pesticides with the same mode of action are repeatedly used to control pests in the same area. As populations have random mutations due to environmental stress, the mutated pests are less likely to be affected by the pesticide and begin to replace the affected pests • at the time of the pesticide application a small proportion of the pest population may survive exposure to the pesticide due to their distinct genetic make-up, lower than recommended dose rate, poor application conditions/method/coverage.	
Accept other relevant answers.	

(b) Outline **one** duty of care requirement for producers and their employees when using pesticides on livestock. (2 marks)

Description	Marks
Outlines a duty of care for producers and their employees when using pesticides on livestock	2
Makes a relevant statement about a duty of care for producers and their employees when using pesticides on livestock	1
Total	**2**
Answers could include: • access to Safety Data Sheet (SDS) information • provision of appropriate safety equipment when handling/applying/cleaning up • suitable training provided in the use of pesticides and the correct use of safety equipment.	
Accept other relevant answers.	

Question 25 (continued)

(c) (i) Compare the level of compliance of the various animals that were tested.
(2 marks)

Description	Marks
Compares the compliance rate of the animals in the table	2
Makes a relevant statement about compliance rate of the animals in the table	1
Total	**2**
Answers could include: Sheep, pigs and cattle have a much higher sample number than animals such as donkey and camel. The meats with much higher sample numbers do not have 100% compliance.	
Accept other relevant answers.	

(ii) Outline **one** reason for the differences in compliance rates. (2 marks)

Description	Marks
Outlines a reason for a difference in compliance rates	2
States a relevant reason for a difference in compliance rates	1
Total	**2**
Answers could include: The greater the number of samples, the less likely to have a 100% compliance rate, possibly due to human error in producing the livestock.	
Accept other relevant answers.	

(iii) Outline the possible effect of these monitoring results on Australia's animal export markets. (2 marks)

Description	Marks
Outlines a possible effect of these monitoring results on Australia's animal export markets	2
States a possible effect of these monitoring results on Australia's animal export markets	1
Total	**2**
Answers could include: • no effect due to the very low incidence of contamination • a market that does receive some contaminated product could reject that product, creating market uncertainty and tarnishing Australia's 'clean, green image'.	
Accept other relevant answers.	

(d) Explain how a livestock producer could alter their animal production system in response to a consumer trend driven by pesticide use. (4 marks)

Description	Marks
Explains how a producer could alter their animal production system in response to a consumer trend driven by pesticide use	4
Describes how a producer could alter their animal production system in response to a consumer trend driven by pesticide use	3
Outlines how a producer could alter their animal production system in response to a consumer trend driven by pesticide use	2
States a relevant fact about how a producer could alter their animal production system in response to a consumer trend driven by pesticide use	1
Total	**4**
Answers could include: • consumer preferences for meat products that have been produced taking into account the environment and health impacts are making producers take greater notice of the use of pesticides • organic certified production guarantees the consumer that the product was not exposed to pesticides. This type of production system produces less, costs more and requires the farm to undergo rigorous audits before accreditation is granted • changing to breeds that are less susceptible to pests will not eradicate pesticides but will minimise their use • use of Integrated Pest Management (IPM), which uses a suite of control methods instead of relying on pesticides.	
Accept other relevant answers.	

Question 26 **(17 marks)**

(a) Complete the table below, stating **one** short-term and **one** long-term strategy for each goal relevant to an animal production enterprise. (8 marks)

Description			Marks
For each short-/long-term strategy (8 x 1 mark)			
Makes a relevant statement			1
		Total	**8**
Answers could include:			
Goal	**Short-term strategy**	**Long-term strategy**	
Increase on-farm water efficiency	Irrigate at appropriate times of day	Autofill watering systems, with alarms/notifications	
Improve soil health	Add organic matter	Improve pasture composition to increase biodiversity	
Utilise renewable energy	Install solar systems	Apply for renewable energy grants to pay back equipment	
Enhance animal welfare	Respond to immediate health needs Train staff	Rotation of pesticides to avoid resistance Redesign animal handling	
Accept other relevant answers.			

(b) Outline how implementing **one** new technology could increase both on-farm efficiency **and** sustainability. (4 marks)

Description	Marks
Increasing efficiency	
Outlines how implementing a new technology could be used to increase on-farm efficiency	2
Makes a statement linking a new technology with on-farm efficiency	1
Subtotal	**2**
Increasing sustainability	
Outlines how implementing a new technology could be used to increase on-farm sustainability	2
Makes a statement linking a new technology and on-farm sustainability	1
Subtotal	**2**
Total	**4**
Answers could include: Electronic identification (EID) systems involve tagging sheep with electronic tags containing unique identification numbers. These tags can be scanned electronically, allowing for quick and accurate identification of individual animals. Analysing this data can give information about animal performance, such as growth rates, feed conversion efficiency and reproductive performance, which can help make an enterprise more profitable and therefore sustainable. On-farm efficiency can be increased as EID systems reduce the time and labour required for tasks such as record keeping and pedigrees.	
Accept other relevant answers.	

(c) Outline a challenge which may occur when implementing a new technology to optimise an animal production system. (2 marks)

Description	Marks
Outlines a relevant challenge which may occur when implementing a new technology to optimise an animal production system	2
Makes a statement about a challenge which may occur when implementing a new technology to optimise an animal production system	1
Total	**2**
Answers could include: Adopting new technologies often requires significant upfront investment in equipment, infrastructure and training. The financial barrier to adopting new technologies can hinder the ability of farmers to improve productivity, efficiency and sustainability in livestock production.	
Accept other relevant answers.	

(d) Explain how a new technology could assist in monitoring the impact of climate change on an animal production system. (3 marks)

Description	Marks
Explains how a new technology could assist in monitoring the impact of climate change	3
Outlines how a new technology could assist in monitoring the impact of climate change	2
Makes a statement about how new technology could assist in monitoring the impact of climate change	1
Total	**3**
Answers could include: Farmers can use remote sensing technology and satellite imagery to monitor changes in land use, vegetation cover and environmental conditions that may affect animal production systems. These tools can provide valuable insights into factors, such as drought severity, pasture availability and vegetation quality with real-time data collection, analysis and predictive modelling capabilities, allowing farmers to adjust management practices accordingly.	
Accept other relevant answers.	

Section Three: Extended answer **30% (40 Marks)**

Question 27 **(20 marks)**

(a) Using the livestock production system you have studied, outline how the hormones above play a critical role in a natural breeding program. (10 marks)

Description	Marks
For each hormone (5 x 2 marks)	
Outlines the role that the stated hormone plays in a natural breeding behaviour program	2
Makes a relevant statement about the hormone	1
Total	**10**

Answers could include:

- in a beef cattle production system, hormones play a critical role in regulating natural breeding behaviour and reproduction
- Gonadotropin releasing hormones (GnRH) initiates the cascade of hormonal events leading to follicle development, ovulation and the production of viable sperm. It is produced by the hypothalamus and stimulates the release of follicle-stimulating hormone (FSH) and luteinizing hormone (LH) from the anterior pituitary gland
- FSH plays a key role in gametogenesis (the development of eggs in females and sperm in males). In females, FSH stimulates the growth and maturation of ovarian follicles, which house the eggs. In males, it stimulates the Sertoli cells in the testes, supporting spermatogenesis (sperm production)
- in females, LH surge triggers ovulation, the release of a mature egg from the ovary. It also promotes the formation of the corpus luteum, which produces progesterone, essential for maintaining pregnancy. In males, LH stimulates the Leydig cells in the testes, leading to the production of testosterone
- oestrogen stimulates the growth of the endometrium (uterine lining) and has negative feedback effects on the release of GnRH, FSH, and LH
- testosterone stimulates spermatogenesis in males. It acts on the Sertoli cells within the testes, supporting the development and maturation of sperm cells
- in both sexes, oestrogen and testosterone contribute to sexual maturation, libido, and mating behaviours necessary for successful breeding.

Accept other relevant answers.

(b) Using the livestock production system you selected in part (a), outline **one** natural livestock breeding technique and **two** artificial breeding techniques, including an example of a relevant ethical issue. Compare how the desired outcomes of these three selected techniques can be used to progress toward breeding goals. (10 marks)

Description	Marks
Natural livestock breeding technique	
Outlines a natural livestock breeding technique and a relevant ethical issue	2
Identifies a natural livestock breeding technique or an ethical issue	1
Subtotal	**2**
Artificial livestock breeding technique (2 x 2 marks)	
Outlines an artificial livestock breeding technique and a relevant ethical issue	2
Identifies an artificial livestock breeding technique or an ethical issue	1
Subtotal	**4**
Compare desired outcomes	
Compares intended outcomes of the three techniques with reference to breeding goals	4
Explains intended outcomes of the three techniques with reference to breeding goals	3
Outlines intended outcomes of the three techniques	2
Identifies intended outcomes of the three techniques	1
Subtotal	**4**
Total	**10**

Answers could include:

Selective breeding is a natural breeding technique that involves choosing breeding pairs with desired traits to improve the genetic makeup of the herd over successive generations. Selection is based on desired heritable traits such as wool or milk production, meat quality or disease resistance. One potential ethical issue with selective breeding is the risk of injury or aggression between animals during mating, particularly if there is competition among males for access to females. This can lead to injuries or stress for the animals involved.

Artificial insemination (AI) is an artificial breeding technique that involves introducing semen from a selected male into a female's reproductive tract without natural mating. One ethical concern with AI is the potential for reduced genetic diversity within the population if only a small number of superior males are used for semen collection. This can lead to increased genetic homogeneity and vulnerability to diseases or environmental changes.

Embryo transfer (ET) is an artificial breeding technique which involves collecting embryos from a genetically superior female and transferring them to the reproductive tract of another female (surrogate). An ethical consideration with embryo transfer is the welfare of the donor and recipient animals, particularly regarding the hormonal treatments and surgical procedures involved in the process. There is a risk of stress, discomfort or complications associated with these procedures.

The primary goal of selective breeding is to improve the overall genetic merit of a population by selecting for traits such as milk production, meat quality, disease resistance and reproductive performance. Over time, selective breeding can lead to the accumulation of favourable genetic traits within the population. These desirable traits are based on the breeding goals of the selected enterprise. AI and ET improve genetic gain and can therefore improve towards breeding goals more quickly than selective breeding, though selective breeding will generally be cheaper under normal circumstances. AI allows for the use of genetic material from superior males, increasing the rate of genetic progress, while ET accelerates genetic improvement by producing multiple offspring from a genetically superior female. AI is generally more cost effective and can be used to service more animals in the herd, as collection and transfer of embryos requires more specialised equipment and skills than collecting semen.

Accept other relevant answers.

Question 28 (20 marks)

(a) Discuss **two** national, state or on-farm protection strategies that an animal production system should consider to maintain Australia's global competitiveness. (10 marks)

Description	Marks
For each protection strategy (2 x 5 marks)	
Discusses a protection strategy to maintain Australia's global competitiveness	5
Explains a protection strategy to maintain Australia's global competitiveness	4
Describes a protection strategy to maintain Australia's global competitiveness	3
Outlines a protection strategy to maintain Australia's global competitiveness	2
Identifies a protection strategy to maintain Australia's global competitiveness	1
Subtotal	**5**
Total	**10**

Answers could include:

Quarantine measures are a protection strategy that help maintain Australia's global competitiveness by supporting national biosecurity. Quarantine and other biosecurity protocols are important to prevent the introduction and spread of infectious diseases, pests, and pathogens that could negatively impact animal health, productivity and market access. These impact global competitiveness. To maintain current competitiveness, surveillance, early detection and rapid response capabilities must be maintained to effectively manage disease outbreaks and minimise their economic and social impacts on livestock systems.

Australia can engage in trade negotiations and advocate for the reduction or elimination of tariffs on livestock products through bilateral or multilateral trade agreements to maintain Australia's global competitiveness. Tariffs could enhance the competitiveness of Australian livestock products by making imported goods relatively more expensive compared to domestic products. However, tariffs can also hinder Australia's global competitiveness by increasing the cost of exporting livestock products to foreign markets. High tariffs imposed by trading partners can limit market access for Australian exporters and reduce the competitiveness of Australian livestock products in international markets.

Accept other relevant answers.

(b) Define 'intergenerational equity'. Describe the long-term strategies that could be implemented by farmers to improve farm resources and promote intergenerational equity, using the triple bottom line. (10 marks)

Description	Marks
Definition of 'intergenerational equity'	
Intergenerational equity is ensuring that the wellbeing of future generations (social, economic and environmental factors) are not compromised by the activities of the current generation	1
Subtotal	**1**
For each of social, economic and environmental strategies (3 x 3 marks)	
Describes a strategy to promote intergenerational equity	3
Outlines a strategy to promote intergenerational equity	2
States a strategy to promote intergenerational equity	1
Subtotal	**9**
Total	**10**

Answers could include:

- to improve farm resources and promote intergenerational equity, farmers must implement long-term strategies to ensure that the wellbeing of future generations, including social, economic and environmental factors, are not negatively impacted by activities of the current generation
- environmental strategies can include implementing sustainable agricultural practices that prioritise soil health, water conservation and biodiversity conservation. This could include the adoption of practices, such as crop/pasture rotation, no-till farming and agroforestry, to improve soil fertility, reduce erosion and enhance ecosystem resilience
- economic strategies are involved with ensuring the enterprise remains profitable. This can be aided by embracing technological innovations such as precision agriculture, data analytics, and smart farming technologies to optimise resource use, improve productivity, and also reduce environmental impact. Technology can also be used to develop (and then adopt) sustainable agricultural technologies, such as enhancing livestock genetics for improved productivity and environmental adaptation
- an important social strategy is the development of a succession plan to ensure the smooth transition of farm ownership and management to the next generation. This will require open communication and collaboration among family members, stakeholders, and advisors to clarify roles, responsibilities and expectations for future farm management. Another social strategy is to provide opportunities for training, education, and mentorship to prepare the next generation of farmers for leadership roles and empower them to make informed decisions about the future of the farm.

Accept other relevant answers.

Question 29 (20 marks)

(a) Explain the importance of the global economy to Australian animal production. Discuss the key characteristics of a major market (i.e. a country) for Australian livestock products, including a major competitor in this market. (10 marks)

Description	Marks
Importance of the global economy	
Explains the importance of the global economy to Australian production	4
Describes the importance of the global economy to Australian production	3
Outlines the importance of the global economy to Australian production	2
States a fact about the importance of the global economy to Australian production	1
Subtotal	**4**
Key characteristics of a major market	
Discusses the key characteristics of a major market for Australian livestock	5
Explains the key characteristics of a major market for Australian livestock	4
Describes the key characteristics of a major market for Australian livestock	3
Outlines the key characteristics of a major market for Australian livestock	2
States a fact about a major market for Australian livestock	1
Subtotal	**5**
Relevant competitor	
Identifies a relevant competitor	1
Subtotal	**1**
Total	**10**

Answers could include:

The global economy plays a crucial role in Australian livestock production by influencing demand for Australian meat and livestock products in international markets. Export markets provide valuable opportunities for Australian farmers to sell their products overseas, contributing to the profitability and sustainability of the livestock industry. Additionally, changes in global economic conditions, such as currency exchange rates and trade policies, can impact the competitiveness of Australian livestock products in the global marketplace, which affects farm incomes and economic sustainability.

China is a major market for Australian meat. China is a significant overseas buyer of Australian lamb, mutton and beef. New Zealand is a key competitor in this market, as they are also known for high-quality lamb exports, as desired by the Chinese market.

The United States is in Australia's top three beef exports and, due to lower domestic production, the market is still increasing for Australian beef exports to the US. Brazil is a key competitor in the US market for Australian livestock products. Brazil is one of the world's largest beef exporters and competes with Australian beef in the US market, particularly in segments such as processed beef and grass-fed products.

Characteristics could include close proximity, large population, consumer demand for high quality products.

Accept other relevant answers.

(b) Explain, using an example for each, **two** comparative advantages that Australian livestock producers have in the international market. (10 marks)

Description	Marks
For each comparative advantage (2 x 5 marks)	
Explains a comparative advantage that Australian livestock producers have in the international market, using an example	5
Describes a comparative advantage that Australian livestock producers have in the international market, using an example	4
Outlines a comparative advantage that Australian livestock producers have in the international market, using an example	3
States a comparative advantage and provides an example	2
States a comparative advantage or provides an example	1
Subtotal	**5**
Total	**10**

Answers could include:

Comparative advantage explains how countries can benefit from trade by specialising in producing goods or services that they can produce more efficiently than other countries.

A comparative advantage that Australian livestock producers have in the international market is their ability to produce disease-free sheep for the global wool market. Australian producers have a long history of selective breeding and genetic improvement programs, producing sheep with desirable wool traits and, more recently, a focus on pest resistance. Also, Australia's strict quarantine and biosecurity measures ensure that its sheep are free from major diseases, such as foot-and-mouth disease (FMD) and sheep scab, which can impact wool quality and market access in other countries. This disease-free status enhances the reputation of Australian wool as clean and safe.

Another comparative advantage that Australian livestock producers have in the international market is their ability to produce high-quality grass-fed beef. Feedlot-fed beef produced in other countries, such as the United States or Brazil, can be compared to Australian grass-fed beef. Australia has extensive grazing systems, allowing cattle to feed on a natural diet of grass and forage, resulting in beef that is leaner and higher in beneficial Omega-3 fatty acids and able to be marketed as such.

Accept other relevant answers.

ACKNOWLEDGEMENTS

Question 21(a)

Dot point 1, sentence 1 adapted from: Brown, G. C. (1997, Summer). Simple Models of Natural Enemy Action and Economic Thresholds. *American Entomologist, 43*(2), p. 117. Retrieved October, 2024, from https://academic.oup.com/ae/article-pdf/43/2/117/18740180/ae43-0117.pdf

Dot point 2, sentence 1 adapted from: Anyim, A. & Umeh, O. J. (2019). Pesticides Safety on Food Crops Among Farming Households in Nigeria. *International Journal of Advanced Research in Botany, 5*(1), p. 42. Retrieved October, 2024, from https://www.arcjournals.org/pdfs/ijarb/v5-i2/4.pdf
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Question 22(a)

Dot point 7, sentence 1 adapted from: Mahawer, S., Karakoti, H., Bargali, P., et al. (2024). Chapter 1 An Introduction to Biorational Pest Control Agents. In R. Kumar, M. de Oliveira, E. de Aguiar Andrade, et al. (Eds.), *Biorationals and Biopesticides: Pest Management* (pp. 1–22). De Gruyter. Retrieved October, 2024, from https://doi.org/10.1515/9783111204819-001

Question 29(a)

Dot point 2, sentence 2 from: Global Ag Media. (2023, December 12). *China Lifts Meat Import Restrictions From 3 Australian Abattoirs*. The Beef Site. Retrieved October, 2024, from https://www.thebeefsite.com/news/china-lifts-meat-import-restrictions-from-3-australian-abattoirs

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