



ANIMAL PRODUCTION SYSTEMS

ATAR course examination 2022

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

Section Two: Short answer

50% (100 Marks)

Question 21

(19 marks)

- (a) (i) Describe how the endocrine system influences body systems. (3 marks)

Description	Marks
Describes how the endocrine system influences body systems.	3
Outlines how the endocrine system influences body systems.	2
Makes a relevant statement about the endocrine system.	1
Total	3
Answers could include: <ul style="list-style-type: none"> • fluctuating hormone levels affect the function of specific body systems • endocrine system works via hormones which are produced by glands • a hormone is a chemical messenger which is carried in blood to target organ/s where it affects the function of the organ/s, such as ovaries and testes. 	
Accept other relevant answers.	

- (ii) Identify a hormone released from the pituitary gland that affects the functioning of the reproductive system and outline how it does so. (3 marks)

Description	Marks
Identifies a reproductive hormone released from the pituitary gland that affects the functioning of the reproductive system.	1
Subtotal	1
Outlines how a hormone released from the pituitary gland affects the functioning of the reproductive system.	2
States a relevant fact.	1
Subtotal	2
Total	3
Answers could include: <ul style="list-style-type: none"> • example of hormone: FSH (follicle stimulating hormone) or LH (luteinising hormone) • oxytocin causes uterine contraction during parturition, milk let down and maternal bonding • target organs (of both FSH and LH) are testes (males) and ovaries (females) • FSH controls sperm production (males) and maturation of ovarian follicles and oestrogen synthesis (females) • LH stimulates testosterone production (males), LH-surge triggers ovulation and progesterone production by corpus luteum (females). 	

Question 21 (continued)

- (b) For each sex, identify a hormone released by the gonads that controls natural breeding behaviour. Describe the effect of each hormone on natural breeding behaviour and successful conception. (8 marks)

Description	Marks
For each hormone identified (2 x 1 mark)	
Identifies a relevant hormone.	1
Subtotal	2
For each effect described (2 x 3 marks)	
Describes the effect on natural breeding behaviour and successful conception.	3
Outlines the effect on natural breeding behaviour.	2
Makes a relevant statement.	1
Subtotal	6
Total	8
<p>Answers could include:</p> <p>Male:</p> <ul style="list-style-type: none"> • testosterone • controls libido / sex drive • ensures that male is willing to mate • increased number of matings increases chance of all females becoming pregnant • ideally all females will be mated in a relatively short period of time. <p>Female:</p> <ul style="list-style-type: none"> • oestrogen • stimulates oestrus / heat behaviour • period when female is willing to mate • ensures mating occurs close to ovulation when female is most fertile. 	
Accept other relevant answers.	

- (c) State **one** method of artificially manipulating the female reproductive cycle and explain its use in commercial animal production systems. (5 marks)

Description	Marks
Method	
States a method.	1
Subtotal	1
Explanation	
Explains use of method to artificially manipulate the female reproductive cycle.	4
Describes use of method to artificially manipulate the female reproductive cycle.	3
Outlines use of method to artificially manipulate the female reproductive cycle.	2
Makes a general comment about artificially manipulating the female reproductive cycle.	1
Subtotal	4
Total	5
<p>Answers could include:</p> <p>Method:</p> <ul style="list-style-type: none"> oestrus synchronisation. <p>Explanation:</p> <ul style="list-style-type: none"> especially useful if a large number of females are to be bred at once ensures that all females are at same stage in cycle (oestrus) at the same set time and all pregnancies commence at same time, decreasing birthing period tasks such as marking, weaning, can be done for all offspring at same time – saving on labour, time etc. at sale time, all animals should meet market specifications such as weight and condition so there is less risk of price reductions for animals not meeting specifications if used with artificial insemination, then saves time and labour as all females can be inseminated at the same time does require some training and purchase of hormones and devices such as CIDR, also procedure can be time consuming and involve repeated handling of animals, and can be invasive and potentially stressful for animals cost of procedure should be less than economic benefits from increased income and reduction in some other costs. <p>Accept other relevant answers.</p>	

Question 22

(17 marks)

- (a) (i) Summarise the suitability of each of the following feeds and additives when formulating a finishing ration for ruminants in a feedlot. (8 marks)

Description	Marks
For each feed or additive (4 x 2 marks)	
Summarises suitability to be used in a ruminant's ration.	2
States a relevant fact on the suitability to be used in a ruminant's ration.	1
Total	8
<p>Answers could include:</p> <ul style="list-style-type: none"> • Barley – suitable, common grain for feed lotting ruminants, relatively high crude protein (CP) when compared to cereal straw. Also contains good levels of metabolised energy (ME). Important to manage introduction to this feed to limit possible digestive issues such as acidosis. • Cereal straw – suitable, contains very low levels of CP and ME. Generally only used as a form of roughage, should only be 10 to 30% of a finishing ration. Not recommended in larger amounts as ruminants will not consume sufficient quantities to meet their production needs. • Meat meal – not suitable as this is classified as a Restricted Animal Material (RAM). In Australia it is illegal to feed certain types of animal material to ruminants. • Urea – suitable, as it is a source of non-protein nitrogen that the ruman bacteria can use effectively instead of protein thereby reducing the requirements of true protein. The maximum amount of urea to use is 1.5%. Higher levels in the ration can cause serious toxicity issues/losses. Care must be taken when mixing to ensure an even distribution, thus avoiding potential toxicity issues. 	

- (ii) Select the **two** most suitable ingredients from part (a)(i) for this ration. (2 marks)

Description	Marks
Barley	1
Urea	1
Total	2

- (iii) Using a Pearson square, calculate the amount of each ingredient required to produce 50 tonnes of rations. Show all workings in the space provided below. (4 marks)

Description	Marks
Converts each ingredient into tonnage.	1–2
Subtotal	2
States correct ratio or parts required for each ingredient.	1–2
Subtotal	2
Total	4
<p>Answers could include:</p> <p>Barley: Amount = $266/270 \times 50 = 49.26$ tonnes</p> <p>Urea: Amount = $4/270 \times 50 = 0.74$ tonnes</p> <div style="text-align: center;"> <pre> graph TD A[Barley 10] --- B((14)) C[Urea 280] --- B D[266/270] --- B E[4/270] --- B </pre> </div> <p>Accept other relevant answers.</p>	

- (b) Describe the relationship between a least-cost ration and the profitability of an animal production system. (3 marks)

Description	Marks
Describes the relationship between a least-cost ration and the profitability of an animal production.	3
Outlines the relationship between a least-cost ration and the profitability of an animal production.	2
Makes a general comment about least-cost ration or the profitability of an animal production.	1
Total	3
<p>Answers could include:</p> <ul style="list-style-type: none"> when formulating the ration need to consider all overarching factors to maximise profitability, not solely the cheapest ingredients. A ration that can be produced for the least cost for the benefit returned in animal performance (e.g. growth, productivity, longevity, reproductive performance, etc.) least cost ration should control/restrain feed costs while maintaining an optimum level of animal performance/product quality and quantity, therefore maximising profitability. <p>Accept other relevant answers.</p>	

Question 23

(17 marks)

- (a) Outline the main hypothesis that is being tested in this investigation. (2 marks)

Description	Marks
Outlines a hypothesis that links independent and dependent variables, including temperature.	2
Makes a relevant statement, including two variables.	1
Total	1
Answers could include: <ul style="list-style-type: none"> as temperature increases, the gross energy demand of fish increases/decreases/does not change. 	

- (b) Describe how each of the following aspects of good experimental design could have been achieved in this investigation. (9 marks)

- Controlled variables
- Randomisation
- Replication

Description	Marks
For each of the 3 aspects (3 x 3 marks)	
Describes how the aspect could have been achieved.	3
Outlines how the aspect could have been achieved.	2
Makes a general comment on the aspect.	1
Total	9
Answers could include: <p>Controlled variables:</p> <ul style="list-style-type: none"> number of fish in each group frequency and type of handling feed type and quality tank size/living space age of fish gender of fish. <p>Randomisation:</p> <ul style="list-style-type: none"> individuals should be allocated to each group randomly by allocating individuals numbers and using random number generation to allocate individuals to each temperature group mention different method of random allocation. <p>Replication:</p> <ul style="list-style-type: none"> multiple fish used in investigation multiple fish tested at each temperature repeat the investigation under the same conditions. Accept other relevant answers.	

- (c) Present a detailed conclusion from the data shown in the graph on page 13. (3 marks)

Description	Marks
Presents a detailed conclusion.	3
Outlines a conclusion.	2
States a simple conclusion.	1
Total	3
Answers could include:	
<ul style="list-style-type: none"> • heavier fish have higher gross energy demands than lighter fish • at higher temperatures the fish have greater gross energy demand • the increase in gross energy demand with increasing weight is more rapid at higher temperatures. 	
Accept other relevant answers.	

- (d) Using the data provided, consider the economic impact of farming barramundi fish at a temperature of 35 °C. (3 marks)

Description	Marks
Considers the impact, using the data provided to support answer.	3
Outlines the impact, using the data provided to support answer.	2
Makes a relevant comment about the impact.	1
Total	3
Answers could include:	
<ul style="list-style-type: none"> • at 35 °C the fish have greater gross energy demand than at lower temperatures • e.g. a 300 g fish requires 150 KJ energy at 25 °C, but nearly 500 KJ at 35 °C • so fish will cost more to feed (will need more food or higher energy food) than the same size fish at lower temperatures • greater cost to feed fish at higher temperatures, with same size fish to sell, and so a similar sale price (compared to fish grown at lower temperatures) • same income but higher costs will result in reduced profit. 	
Accept other relevant answers.	

Question 24

(16 marks)

- (a) Outline how the information in the graph above is linked to climate change. (2 marks)

Description	Marks
Outlines how the information in the graph is linked to climate change.	2
States a fact about how the information in the graph is linked to climate.	1
Total	2
Answers could include:	
<ul style="list-style-type: none"> from 1880 to 2020 there has been a progressive rise in global carbon dioxide concentrations, from approximately 290 ppm to 410 ppm from approximately 1970 onwards, there have been progressively larger increases in average temperature, from 0 to 0.9 °C suggesting that the 2 variables are linked. 	
Accept other relevant answers.	

- (b) (i) Identify
- one**
- predicted result of climate change and describe its impact on an animal production system. (4 marks)

Description	Marks
Identifies one predicted result of climate change.	1
Subtotal	1
Impact on animal production system	
Describes the impact on an animal production system.	3
Outlines the impact on an animal production system.	2
States a fact about an impact on an animal production system.	1
Subtotal	3
Total	4
Answers could include:	
Commonly recognised climate predictions:	
<ul style="list-style-type: none"> higher temperatures hotter and more frequent hot days less winter and spring rainfall higher intensity rainfall events increased evaporation reduced soil moisture and run-off longer drought periods. 	
Climate change will cause a range of economic, social and environmental consequences, including negative impacts to agricultural productivity, water resource pressures and loss of biodiversity with associated environmental impacts.	
Impact on animal production systems:	
<ul style="list-style-type: none"> greater exposure of livestock to heat related stress and disease decline in pasture production due to increased drought and decreased soil moisture southern migration of some pests infecting livestock which have little or no immunity reduced run-off into catchments resulting in stock water shortages negative impact on viability/sustainability of agricultural businesses increases in insurance premiums greater reliance on supplementary feeding land degradation – erosion (soil, wind and water), soil fertility decline, salinisation, waterlogging, lowering of water table etc. 	
Accept other relevant answers.	

- (ii) Outline **three** strategies that could be used to help an animal production system respond to the climate change prediction identified in part (b)(i). (6 marks)

Description	Marks
For each strategy (3 x 2 marks)	
Outlines a strategy that could be used.	2
Identifies a strategy that could be used.	1
Total	6
<p>Answers could include:</p> <p>Higher temperatures:</p> <ul style="list-style-type: none"> • breed for heat tolerance • improve availability of shade via shelter belts and/or artificial shade • alter management practices to avoid excessive heat periods • select heat tolerant pasture species • change calendar of operations and husbandry tasks to suit weather conditions • reduce physiological stress on livestock. <p>Lower rainfall</p> <ul style="list-style-type: none"> • improve water resource management – improve/increase water catchment/storage, improve irrigation efficiency, sow pasture water tolerant species. <p>Other:</p> <ul style="list-style-type: none"> • food on offer (FOO) pasture, improve fodder conservation strategies • more efficient use/conservation of natural resources e.g. water, feed • seek professional assistance/advice on dealing with impacts – government agencies, farm advisors, company technical advisors • maintain soil fertility for higher yielding pasture and fodder crops. <p>Accept other relevant answers.</p>	

Question 24 (continued)

- (c) Identify a technology that could be used to manage climate change risk in livestock production. Describe the importance of this technology in optimising production. (4 marks)

Description	Marks
Identifies a relevant technology.	1
Subtotal	1
Importance of technology	
Describes the importance of the technology in optimising production.	3
Outlines the importance of the technology in optimising production.	2
States a fact about the technology.	1
Subtotal	3
Total	4
<p>Answers could include:</p> <p>Examples of relevant technologies:</p> <ul style="list-style-type: none"> • satellite imagery and accompanying weather forecasting software • weather apps • digital weather stations – soil and uv index sensors. <p>Importance of technology – climate/weather forecast technologies:</p> <ul style="list-style-type: none"> • by utilising climate/weather forecasting technologies a producer has the capacity to make informed tactical changes to management decisions based on seasonal forecasts, e.g. on forecast of upcoming drier conditions a producer could decide to acquire additional supplementary grain/hay • producers also have the capacity to evaluate the short, medium and long term impacts of climate change to the farming operation and identify possible adaption options. 	
Accept other relevant answers.	

Question 25

(13 marks)

- (a) Use the pedigree chart above to explain the increase in mortality within the breeding stock. (4 marks)

Description	Marks
Explains the data presented within the chart and links it to increased mortality rates.	4
Describes the data presented within the chart and links it to increased mortality rates.	3
Outlines the data presented within the chart and links it to increased mortality rates.	2
States a fact regarding the data in the chart.	1
Total	4
Answers could include: <ul style="list-style-type: none"> • chondrodysplasia is a genetic/inherited disorder • caused by a recessive allele/presents when an animal is homozygous for the disease • an individual can inherit one recessive allele but not develop the disease • the pedigree shows that there are a large number of carrier animals in the breeding stock – carriers are unaffected so, unbeknown to the breeder, many have been used in this breeding program • the affected individuals have inherited one disease gene from each carrier parent – these individuals then died. Accept other relevant answers.	

- (b) Describe how using pedigrees to map the heritability of traits can be a valuable tool for producers. (3 marks)

Description	Marks
Describes how pedigrees can be a valuable tool.	3
Summarises how pedigrees can be a valuable tool.	2
Identifies how pedigrees can be a valuable tool.	1
Total	3
Answers could include: <ul style="list-style-type: none"> • allows determination of traits to be passed down in future by taking into consideration: <ul style="list-style-type: none"> ▪ genotype and phenotypes ▪ alleles – dominant and recessive, autosomal or sex linked • trouble shooting by analysing patterns of inheritance • deduce patterns of genetic disorders/diseases for management decisions • follows several generations to provide a detailed history and traceability. Accept other relevant answers.	

Question 25 (continued)

- (c) (i) Describe **one** management strategy that the producer could use to control the incidence of Chondrodysplasia within this herd. (3 marks)

Description	Marks
Describes how a management strategy could be used to control the disease.	3
Outlines how a management strategy could be used to control the disease.	2
States a management strategy.	1
Total	3
Answers could include: <ul style="list-style-type: none"> • DNA test breeding stock to establish the carriers • utilise pedigrees to identify carriers • avoid breeding two carriers together • only use sires free of the disease over carrier dams • remove carrier bulls from the breeding program or castrate when young • cull affected animal(s) from the breeding program. 	
Accept other relevant answers.	

- (ii) Describe **one** breeding technology that the producer could use to control the incidence of Chondrodysplasia within this herd. (3 marks)

Description	Marks
Describes a breeding technology that could be used to control the disease.	3
Outlines a breeding technology that can be used to control the disease.	2
States a breeding technology.	1
Total	3
Answers could include: <ul style="list-style-type: none"> • breeding technologies such as AI, ET • breed from sires that are certified free of the disease, using AI or ET. 	
Accept other relevant answers.	

Question 26

(18 marks)

- (a) Use the information provided above to complete boxes A-F in the table below. (6 marks)

Description	Marks
A $120 \times \$160 = \$19\,200$	1
B $120 \times \$180 = \$21\,600$	1
C Total Income - Total Expenses $\$19\,200 - \$8\,400 = \$10\,800$	1
D Total Income - Total Expenses $\$21\,600 - \$10\,488 = \$11\,112$	1
E $\$8,500/100 = \$90/\text{hd}$	1
F $\$9260/100 = \$92.60/\text{hd}$	1
Total	6

- (b) On the basis of the financial information provided in the gross margin, justify the advice you would give to this producer in relation to feed choice. (5 marks)

Description	Marks
Justifies the advice, with reference to the data.	5
Justifies the advice, with some reference to the data.	4
Provides some justification.	3
Provides limited justification.	2
States a relevant fact.	1
Total	5
<p>Answers could include:</p> <ul style="list-style-type: none"> • more economically efficient to feed lambs on pellets • feeding pellets makes a larger contribution to overall profitability • less overall income feeding grain • although profitable, grain contributes less to overall profitability • pellets get lambs to a higher finishing weight in same timeframe/faster growth • higher price per head for lambs over 65 kgs • lambs under 65 kgs receive less per head. 	

Question 26 (continued)

- (c) Consider the choice of ration if the price of pellets increased to \$700/tonne. Show your workings. (3 marks)

Description	Marks
Considers choice of ration by calculating gross margin and comparing to other ration.	3
Calculates change in feed costs.	2
States that grain ration is now more economically viable.	1
Total	3
Answers could include:	
<ul style="list-style-type: none"> • amount of pellets required = $7488/600 = 12.48$ tonnes • increase in total price of pellets = $12.48 \times 100 = \\$1248$ • so GM will fall to $11\ 112 - 1248 = \\$9864$ • if the price of pellets increased to \$700 per tonne the producer would consider changing to a grain ration. 	
Accept other relevant answers.	

- (d) Events in the global economy can affect Australian agriculture. Explain how worldwide events may have an impact on future animal feed prices. (4 marks)

Description	Marks
Explains how worldwide events may affect feed prices.	4
Describes how worldwide events may affect feed prices.	3
Outlines how worldwide events may affect feed prices.	2
States how worldwide events may affect feed prices.	1
Total	4
Answers could include:	
<p>Global events could impact feed prices by either lowering or increasing them. Such events may include:</p> <ul style="list-style-type: none"> • Conflict in other countries <ul style="list-style-type: none"> ▪ fuel embargos may increase energy prices, which inflates feed costs ▪ tariffs increasing or decreasing ▪ port shutdowns impacting supply, increasing prices ▪ new market options and lost markets due to logistics/state of affairs leads to grain price increases/decreases ▪ increases in shipping costs, due to disruptions, increases costs. • Pandemics <ul style="list-style-type: none"> ▪ food (grain) and energy prices increase due to disruptions to supply chain ▪ lack of income worldwide may result in less demand and lower prices for grains ▪ labour to produce and harvest products can reduce supply, increasing costs ▪ failure to access international markets can lower domestic market prices due to excess supply. • Weather conditions in other countries <ul style="list-style-type: none"> ▪ severe weather impacts growth of crops or wipes them out, resulting in a lack of supply ▪ are favourable and result in high yields, which results in lower prices due to abundant supply. • Food security <ul style="list-style-type: none"> ▪ increasing world population is pushing up demand and pricing of grain as is the increased income in third world countries. 	
Accept other relevant answers.	

Question 27

(20 marks)

- (a) (i) Identify **three** measurable market requirements of your enterprise's marketed product. (3 marks)

Description	Marks
Identifies three measurable market requirements.	3
Identifies two measurable market requirements.	2
Identifies one measurable market requirement.	1
Total	3
<p>Answers could include:</p> <p>Market requirements (specific to enterprise product):</p> <ul style="list-style-type: none"> • Wool <ul style="list-style-type: none"> ▪ requirements based on wool class, fibre diameter (e.g. fine micron wool 17 – 19 micron), low vegetable matter content, staple length and strength • Lamb <ul style="list-style-type: none"> ▪ supermarket lamb – carcase weight 18 to 22 kg, fat scores 2 and 3 with a preference for second cross ▪ heavy export – carcase weight 20 to 30 kg fat scores 2 to 4, North America for prime cuts • Milk <ul style="list-style-type: none"> ▪ percentage milk fat and protein, temperature, somatic cell count ▪ according to Food Standards Australia New Zealand, packaged cows' milk for retail sale requires that it contain at least 3.2% fat and 3% protein, skim milk must contain a maximum of 0.15% fat and a minimum of 3% protein • Beef <ul style="list-style-type: none"> ▪ hot standard carcase weight (HSCW), rump (P8) fat depth, meat and fat colour, meat yield, no bruising, e.g: <ul style="list-style-type: none"> ◦ local trade – HSCW 320 to 420 kg, P8 fat depth 6 to 22 mm, no bruising ◦ EU market – HSCW 300 to 420 kg, P8 fat depth 7 to 22 mm, no bruising or HGP • Seed stock <ul style="list-style-type: none"> ▪ requirements could be based on breed type, age, estimated breeding values, structure, muscling, maturity, bloodlines, growth rate. <p>Other possible market requirements could include:</p> <ul style="list-style-type: none"> • free from chemical residues – adhere to withholding periods (WHP) • traceability – transfer of animals via National Livestock Identification system (NLIS), animal identification (e.g. ear marking, NLIS tag, tattoo, branding, etc.) • health status – vaccination, disease free • quality assurance (QA) stipulations – access to water, days of feed, approved abattoir. 	
Accept other relevant answers.	

Question 27 (continued)

- (ii) Describe **one** factor that has a significant impact on product quality and explain a risk mitigation strategy used to manage this. (7 marks)

Description	Marks
Factor	
Describes one factor that has a significant impact on product quality.	3
Outlines one factor that has a significant impact on product quality.	2
Identifies a factor that has an impact on product quality.	1
Subtotal	3
Risk mitigation strategy	
Explains a risk mitigation strategy to manage the stated factor.	4
Describes a risk mitigation strategy to manage the stated factor.	3
Outlines a risk mitigation strategy to manage the stated factor.	2
Identifies a risk mitigation strategy.	1
Subtotal	4
Total	7
<p>Answers could include:</p> <p>Factors impacting on product quality:</p> <ul style="list-style-type: none"> • nutrition – quality and quantity of feed on offer severely impacts an enterprise's ability to meet market specifications. It's critical to provide an animal with a diet that corresponds to the production system's goal (e.g. lot feeding vs supplementary vs pasture) • weather – extremes in weather conditions, e.g. dry periods result in subsequent shortages of feed, which means the market requirements for product quantity and/or quality will be hard to meet • management of internal and external parasites and diseases – an infestation/outbreak effects ability to access market and degrades the product, which results in a corresponding reduction in price received • handling and transport – poor handling facilities subject animals to potential bruising and injury causing carcass damage. Poor handling techniques can impact greatly on stress levels thus potentially impacting on the quality of the end product. <p>Risk mitigation strategies:</p> <ul style="list-style-type: none"> • nutrition – provide a ration that meets an animal's dietary requirements (e.g. protein, energy, minerals, vitamins), test nutritional value of the feed provided, utilise technologies – GPS collars, smart tags • weather – provide shelter belts, monitor weather forecasts, consider weather when undertaking husbandry tasks • management of internal and external parasites and diseases – implement integrated Pest Management (IPM) plans, introduce industry best practice biosecurity plans, use a vaccination program • handling and transport – use low stress handling techniques, adhere to recommended feed curfews prior to transporting, ensure access to water whilst in holding yards, ensure handling facilities don't subject animals to potential bruising and injury, avoid mixing mobs prior to transportation. <p>Accept other relevant answers.</p>	

(b) Evaluate, using examples, the extent to which your enterprise effectively:

- meets consumer trends
 - incorporates new technologies
- (10 marks)

Description	Marks
Consumer trends	
Evaluates, using examples, how the enterprise effectively meets consumer trends.	5
Explains, using examples, how the enterprise effectively meets consumer trends.	4
Describes, using examples, how the enterprise effectively meets consumer trends.	3
Outlines, using limited/no examples, how the enterprise effectively meets consumer trends.	2
Makes a statement about consumer trends.	1
Subtotal	5
New technologies	
Evaluates, using examples how the enterprise effectively incorporates new technologies.	5
Explains, using examples how the enterprise effectively incorporates new technologies.	4
Describes, using examples how the enterprise effectively incorporates new technologies.	3
Outlines how the enterprise effectively incorporates new technologies, using limited/no examples.	2
Makes a statement about new technologies.	1
Subtotal	5
Total	10
<p>Answers could include:</p> <p>Examples of consumer trends:</p> <ul style="list-style-type: none"> • fine wool production – contraction of wool demand, fine wools produce a higher quality textile, growers move towards breeding finer wool to gain price advantage • marbling in beef – marbling sought after by Asian market, marbling breeds identified, feeding systems adjusted to increase fat in the muscle • organic food production – consumer prefers chemical free products, producers need to be registered to gain certification • production practices e.g. mulesing – finding an alternative or lose certain high-end fashion markets. Wool sold under a declaration. <p>Examples of new technologies:</p> <ul style="list-style-type: none"> • mobile computers, internet capabilities – tablets, smartphones, GPS, high resolution cameras, communication capabilities, apps etc. • electronic productivity monitoring – electronic weighing / drafting, electronic identification • satellite technology – pastures from space • precision farming techniques • breeding technology – gene markers, animal identification (DNA and biometric methods), marker assisted selection (MAS), ultrasound. 	
Accept other relevant answers.	

Question 28

(20 marks)

- (a) Explain how Australian producers contribute to this competitiveness by managing the 'triple bottom line'. Support your response by providing **one** relevant example for each factor. (12 marks)

Description	Marks
For each factor of the 'triple bottom line' (3 x 3 marks)	
Explains how Australian producers contribute to this competitiveness by managing the 'triple bottom line'.	3
Outlines how Australian producers contribute to this competitiveness by managing the 'triple bottom line'.	2
Makes a comment about managing the 'triple bottom line'.	1
Subtotal	9
Examples (3 x 1 mark)	
Provides a relevant example.	1
Subtotal	3
Total	12
<p>Answers could include:</p> <p>If Australian agricultural products can better meet the demands of economic, environmental and social factors, compared to other countries, then this will increase competitiveness for export markets.</p> <p>Economic factors:</p> <ul style="list-style-type: none"> • products must be priced to compete with those from other countries, otherwise Australian products will be less likely to sell • taxes and levies may increase the product price to consumers and so decrease competitiveness • size of production costs, especially Australia's relatively high labour costs, can reduce competitiveness • government subsidies can enable other countries' products to be sold at a cheaper price. <p>Example:</p> <ul style="list-style-type: none"> • pork producers in European Union countries receive government subsidies so can afford to sell products at a lower price than Australian products and still be sustainable. Australian farmers receive considerably lower subsidies so cannot afford to discount their products, thus making them less competitive. Australia markets its exports as superior quality as it often cannot compete based on price alone. <p>Environmental factors:</p> <ul style="list-style-type: none"> • production systems with low environmental footprints are often more desirable to consumers and so increase competitiveness, may also become an expectation of some export markets e.g. carbon footprint • Australian climate extremes e.g. drought can reduce production levels, quality and efficiency and thus decrease competitiveness as less product to sell • quality and quantity of natural resources such as soil and water can affect production. <p>Example:</p> <ul style="list-style-type: none"> • ruminant feed additives which reduce methane emissions not only increase feed efficiency but could give producers a competitive edge based on the relative carbon footprint, thus offering a competitively priced product with reduced environmental impact. 	

Social factors:

- Australia's reputation for meeting consumer requirements regarding food safety, animal welfare, environmental impact (clean, green and ethically produced) increases demand overseas and thus competitiveness with countries that do not meet these standards
- duty of care and OSH laws; a high standard of working conditions attracts skilled workers from overseas, this is also a significant selling point for consumers.

Example:

- Australia's BSE-free status increased its competitiveness against beef exporting countries who suffered outbreaks.

Accept other relevant answers.

Question 28 (continued)

- (b) Assess why the demands of the 'triple bottom line' factors in animal production systems are often in conflict with each other. Support your response by providing **one** example of each factor. (8 marks)

Description	Marks
Demands	
Assesses why the demands are conflicting, with reference to all 3 factors.	5
Explains why the demands are conflicting, with reference to all 3 factors.	4
Describes how the demands are conflicting, with reference to some factors.	3
Outlines how the demands are conflicting, with reference to some factors.	2
Makes a comment about the conflicting demands.	1
Subtotal	5
Examples (3 x 1 mark)	
Provides an example of the factor.	1
Subtotal	3
Total	8
<p>Answers could include:</p> <ul style="list-style-type: none"> • products must be competitively priced while still ensuring profitability e.g. producer and staff receive wages, production costs are kept low, money is available for repairs, upgrading equipment etc. • short term, reducing environmental impact can lead to a loss of productivity or an increase in costs e.g. resting paddocks, reducing stocking density, revegetating cleared land, reducing water use • consumers desire low prices but expect producers to maintain high levels of environmental care and animal welfare e.g. intensive production systems are economically more efficient but are often perceived as being lower welfare than extensive systems • quality of life of producers (social) can be threatened by economic factors and environmental issues, such as drought. <p>Examples could include:</p> <ul style="list-style-type: none"> • economic – selling price of product, cost of production (including wages, feed, infrastructure and equipment) • social – consumer expectations (environmental footprint, animal welfare, food safety etc.), producer employment and quality of life • environmental – impact of production system on natural resources, land management, effects of climate extremes (e.g. drought). <p>Accept other relevant answers.</p>	

Question 29

(20 marks)

- (a) Explain, using a relevant example, the relationship between pesticide mode of action and effectiveness in animal treatment. Describe factors (other than rotation based on mode of action) that can be used to avoid or manage resistance. (8 marks)

Description	Marks
Relationship between mode of action and effectiveness	
Explains the relationship between mode of action and effectiveness in animal treatment.	4
Describes the relationship between mode of action and effectiveness in animal treatment.	3
Outlines the relationship between mode of action and use in animal treatment.	2
States a mode of action and how it can be used in animal treatment.	1
Subtotal	4
Example	
Provides a relevant example.	1
Subtotal	1
Managing pesticide resistance	
Describes how resistance can be managed or avoided.	3
Outlines how resistance can be managed or avoided.	2
States a way resistance can be managed or avoided.	1
Subtotal	3
Total	8
<p>Answers could include:</p> <ul style="list-style-type: none"> • mode of action allows producers to vary specific treatments used to accomplish results suitable to their particular enterprise, making them more efficient • using numerous modes of action in a program can reduce the risk of resistance and manage resistant strains of parasites - give longevity to a pest management program • allows for more selective treatment which can improve efficiency in: <ul style="list-style-type: none"> ▪ limiting resistance ▪ minimising the number of treatments required ▪ reducing costs ▪ minimising pest damage ▪ improve product quality ▪ improve pest management • may have a significant impact on the success of the treatment by affecting the pest at a specific stage assisting effectiveness by: <ul style="list-style-type: none"> ▪ minimising damage to the animal/product ▪ limiting diseases associated with the parasite ▪ preventing further parasite breeding whilst eradicating the parasite to minimise resistance ▪ preventing lifecycle completion as well as environmental contamination. 	

Question 29 (continued)

Examples could include:

- comparison of modes of action for efficiency i.e. Lice: IGR (Insect Growth Regulators) prevent moulting (effecting egg hatching, pupae and larvae stages) and viable eggs, but doesn't kill adult lice, leaving them active on the body whereas chemicals with modes of action that cause paralysis and death prevent further damage to the animal by adult lice
- changing modes of action of chemicals, in order to avoid chemical resistance, with an example suitable to a chosen enterprise, such as switching from synthetic pyrethroids (parasites central nervous system) to spinosyn (parasites neuron system)
- discussion of the use of a chemical, referring to its mode of action when discussing its efficiency, such as:
 - muscle paralysis and then expulsion from the host
 - paralysis and death
 - interruption of neurotransmitters
 - damaging cell membranes
 - impacting Ion channel proteins
 - increased permeability of calcium
 - insect Growth Regulators
 - repellents
 - systemic
 - contact.

Managing pesticide resistance:

- implementing an IPM program to take advantage of non-chemical options such as breeding for resistance, grazing management, biological controls and cultural management practices
- maintaining animal health through good nutrition and reduced stress to boost natural immunity and reduce pest damage
- where possible, purchase stock from well reputed producers and cull susceptible animals out
- implement biosecurity measures and maintain border fencing
- seek the assistance of a veterinarian to create a management plan
- monitor pest levels to assist treatment management through:
 - establishing when treatment is necessary
 - deciding whether to individually treat animals
 - checking for chemical resistance to establish ineffective/effective groups for control
- chemical use should incorporate the following:
 - record products used to create a treatment history going forward
 - alternate modes of action used/rotate chemicals
 - maintain and use appropriate equipment for treatments
 - adhere to the label
- weigh stock and calibrate equipment accordingly.

Accept other relevant answers.

- (b) Explain a management strategy that could be implemented to control pest outbreaks that occur locally, nationally **and** internationally. (12 marks)

Description	Marks
Locally	
Explains a local management strategy.	4
Describes a local management strategy.	3
Outlines a local management strategy.	2
States a local management strategy.	1
Subtotal	4
Nationally	
Explains a national management strategy.	4
Describes a national management strategy.	3
Outlines a national management strategy.	2
States a national management strategy.	1
Subtotal	4
Internationally	
Explains an international management strategy.	4
Describes an international management strategy.	3
Outlines an international management strategy.	2
States an international management strategy.	1
Subtotal	4
Total	12
<p>Answers could include:</p> <p>Locally:</p> <ul style="list-style-type: none"> • Livestock Production Assurance (LPA) on-farm program • on-farm biosecurity measures: <ul style="list-style-type: none"> ▪ manage vehicles/equipment/people entering ▪ quarantining new stock ▪ good fencing and buffer zones ▪ trusted animal feed sources and good storage ▪ controlling feral animals/protect from wild animals (excluding poultry and wild birds) ▪ wash-down bays and foot baths ▪ clean equipment and vehicles ▪ monitoring and surveillance ▪ record keeping ▪ correctly treating animals (chemicals) • local veterinarian • report suspected outbreaks to Department of Primary Industries. 	

Question 29 (continued)

Nationally:

- National Vendor Declarations (NVDs) for tracing the movement of livestock
- National Livestock Identification Scheme (NLIS) trace from property of birth to slaughter
- Department of Agriculture, Water and the Environment:
 - declarations
 - road check points
 - quarantine inspectors at borders, including random mobile inspections
 - import restrictions
 - technology such as scanning
 - detection dogs
 - testing and treating livestock
 - health certificates
 - animal movement suspensions
- Department of Primary Industries and Regional Development
- AUSVET management and response procedures for an outbreak.

Internationally:

- the Australian Government is responsible for managing the threats of international outbreaks. It also has agreements in place with other countries to manage and navigate outbreaks. Animal Health Australia, has the 'Emergency Animal Disease Response Agreement' (EADRA) which provides response plans, training, guidelines, cost allocations etc. to manage an outbreak within Australia.
- the Australian government works with the following when more than one state is impacted:
 - Department of Agriculture, Water and the Environment
 - Department of Primary Industries and Regional Development
- Australia has in place strict quarantine and biosecurity measures that take place at the border, on and off shore, to protect the agricultural industry from pest and disease outbreaks. Some of these methods may include:
 - reporting systems for pest issues
 - quarantining of animals/products entering
 - import requirements
 - border control officers
 - detection dogs
 - scanning
 - declarations
 - legislation
 - surveillance
 - monitoring etc.

Accept other relevant answers.

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Question 27(a)(i) Milk sub-dot point 2 from: Food Standards Australia New Zealand. (2012). *Milk*. Retrieved September, 2022, from <https://www.foodstandards.gov.au/consumer/generalissues/milk/Pages/default.aspx> Used Under a Creative Commons Attribution 3.0 Australia licence.

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